Founded by G. Stanley Hall in 1891, reorganized by Carl Murchison in 1925

JOURNAL OF GENETIC PSYCHOLOGY

Child Behavior, Animal Behavior, and Problems of Aging

EDITED BY

CARL MURCHISON

JOHN E. ANDERSON
University of Minnesota
NANCY BAYLEY
Nat. Institutes of Health
JAMES E. BIRREN
Nat. Institutes of Health
WILLIAM E. BLATZ
University of Toronto
S. K. BOSE
University of Calcutta
CHARLOTTE BÜHLER
Univ. Southern California
CYRIL BURT
University of London
EWALD W. BUSSE
Duke University
LEONARD CARMICHAEL
Smithsonian Institution
WAYNE DENNIS
Brooklyn College
SANTE DE SANCTIS
R. Università di Roma
WILMA T. DONAHUE
University of Michigan
ARNOLD GESELL
Yale University
ROBERT J. HAVIGHURST
University of Chicago
WILLIAM HEALY
Judge Baker Foundation
JOHN E. HORROCKS
Ohio State University
J. McV. HUNT
University of Illinois
WENDELL E. JEFFREY
University of California
ARTHUR T. JERSILD
Columbia University
BUFORD JOHNSON
Johns Hopkins University

If this space should be unstamped, this is the regular library edition. But if this space is stamped with a designating title, this is a special edition, sold under the restrictions of a bilateral contract, and may not be resold for a period of five years from date of publication.

HAROLD E. JONES
University of California
TRUMAN L. KELLEY
Harvard University
WILLIAM KESSEN
Yale University
ROBERT W. KLEEMEIER
Washington University
HEINRICH KLÜVER
University of Chicago
RONALD LIPPITT
University of Michigan
NORMAN L. MUNN
Bowdoin College
BERNICE L. NEUGARTEN
University of Chicago
TORAO OBONAI
Tokyo University
YOSHIKAZU OHWAKI
Tohoku University, Japan
HENRI PIÉRON
Universite de Paris
ARTHUR J. RIOPELLE
Yerkes Lab. Primate Biol.
ROBERT R. SEARS
Stanford University
NATHAN W. SHOCK
Baltimore City Hospitals
HAROLD W. STEVENSON
University of Minnesota
GEORGE D. STODDARD
University of Illinois
GEORGE G. THOMPSON
Ohio State University
C. J. WARDEN
Columbia University
A. T. WELFORD
Cambridge University

VOLUME 98

1961

Copyright, 1961, by The Journal Press
Published Quarterly by The Journal Press
Provincetown, Massachusetts, U. S. A.
Second-class postage paid at Provincetown, Mass.

INDEX OF AUTHORS

Adamson, Robert 307
Altus, William D. 265, 299, 303
Amatora, Sister Mary 133
Antonitis, Joseph J. 95, 177
Badgeley, Elizabeth W. 127
Barnes, Gerald W. 95
Baron, Alan 177
Bereiter, Carl 47
Bevan, William 307
Butler, Robert A. 239
Caldwell, Willard E. 161
Cassel, Russell N. 119
Durkin, Dolores 3
Elkind, David 37, 219
Flavell, John H. 279
Gaier, Eugene L. 63
Gardner, D. Bruce 29
Harlow, Harry F. 183
Hawkes, Glenn R. 29
Henton, Comradge L. 247, 255
James, William T. 273
Kahn, Marvin W. 211
Kish, George B. 177
Lang, Patricia 113
Lerea, Louis 229
Levinson, Boris M. 69
Lewis, George W. 49
Littman, Richard A. 19
Marsumoto, Misao 83
Michels, Kenneth M. 49
Nidorf, Louis J. 19
North, Alvin J. 113
Pease, Damaris 29, 295
Phaup, Minnie Rob 161
Pumroy, Donald K. 55
Pumroy, Shirley S. 55
Riopelle, A. J. 183
Rosauer, Josephine 295
Rosen, Joseph 15
Rosenberg, B. G. 187
Rudin, Stanley A. 147
Schrier, Allan M. 203
Smith, Henrietta T. 83
Stancik, Edward J. 119
Stedman, Donald J. 279
Sundberg, Norman D. 19
Sutton, Rachel S. 193
Sutton-Smith, B. 187
Warren, J. M. 89
Washington, Charles 247
Wolins, Leroy 295

TABLE OF CONTENTS

The specificity of children's moral judgments 3
By Dolores Durkin

Weight gain as a function of early social experience in the albino rat . . 15
By Joseph Rosen

Characteristics of a psychosexual scale: The Krout Personal Preference Scale 19
By Richard A. Littman, Louis J. Nidorf, and Norman D. Sundberg

Responses of two-year-old children to controlled stress situations . . . 29
By D. Bruce Gardner, Damaris Pease, and Glenn R. Hawkes

The development of quantitative thinking: A systematic replication of Piaget's studies 37
By David Elkind

Fluency abilities in preschool children 47
By Carl Bereiter

Strength of secondary reinforcement as a function of the quality of food reward 49
By George W. Lewis and Kenneth M. Michels

Effect of amount and percentage of reinforcement on resistance to extinction in preschool children 55
By Donald K. Pumroy and Shirley S. Pumroy

Student self estimates of final course grades 63
By Eugene L. Gaier

Subcultural values and IQ stability 69
By Boris M. Levinson

Japanese and American children's perception of parents 83
By Misao Matsumoto and Henrietta T. Smith

Individual differences in discrimination learning by cats 89
By J. M. Warren

Group operant behavior: An extension of individual research methodology to a real-life situation 95
By Joseph J. Antonitis and Gerald W. Barnes

Conditional discrimination in rats 113
By Alvin J. North and Patricia Lang

California Test of Mental Maturity *b* weights for predicting a composite score on the Iowa Tests of Educational Development 119
By Russell N. Cassel and Edward J. Stancik

Some indications of muscular armoring in two six-year-old retarded children 127
By Elizabeth W. Badgeley

School interests of early adolescence 133
By Sister Mary Amatora, O. S. F.

Measuring the teacher's effectiveness as a lecturer 147
By Stanley A. Rudin

BOOKS 155

BOOKS RECENTLY PUBLISHED 155

The delayed field drive in the raccoon and cat 161
By Willard E. Caldwell and Minnie Rob Phaup

Stimulus determinants of aggregative behavior in the domestic chicken . . 177
By Alan Baron, George B. Kish, and Joseph J. Antonitis

Stimulus and reward displays in discrimination learning 183
By A. J. Riopelle and Harry F. Harlow

Impulsivity and sex preference 187
By B. Sutton-Smith and B. G. Rosenberg

An analysis of factors related to educational achievement 193
By Rachel S. Sutton

Effects of CS-US interval on avoidance conditioning of cats 203
By Allan M. Schrier

The effect of socially learned aggression or submission on the mating behavior of C57 mice 211
By Marvin W. Kahn

Children's discovery of the conservation of mass, weight, and volume: Piaget Replication Study II 219
By David Elkind

An investigation of auditory figure-ground perception 229
By Louis Lerea

The responsiveness of rhesus monkeys to motion pictures 239
By Robert A. Butler

Differential study of recidivism among negro and white boys 247
By Comradge L. Henton and Charles Washington

The effect of socio-economic and emotional factors on the onset of menarche among negro and white girls 255
By Comradge L. Henton

Questionnaire items and types of intelligence 265
By William D. Altus

Preliminary observations on play behavior in puppies 273
By William T. James

A developmental study of judgments of semantic similarity 279
By John H. Flavell and Donald J. Stedman

Reliability of three infant developmental scales administered during the first year of life 295
By Damaris Pease, Josephine Keefe Rosauer, and Leroy Wolins

SHORT ARTICLES AND NOTES 299

Intellective and non-intellective factors in a classroom test (William D. Altus) 299

Correlative data for first-semester grade averages at the University of California, Santa Barbara (William D. Altus) 303

A multiple-alley straightaway for latency and speed measures (William Bevan and Robert Adamson) 307

BOOKS 311

BOOKS RECENTLY PUBLISHED 311

Journal of Genetic Psychology

EDITED BY
CARL MURCHISON

Quarterly, published in March, June, September, and December. Devoted to child behavior, animal behavior, and the problems of aging. Manuscripts may be sent to any member of the Editorial Board, or may be sent directly to the general editorial office. All subscriptions and business communications should be sent directly to The Journal Press. Two volumes annually. Beginning with 1961, per annum, $20.00; per volume, $15.00; single numbers $7.50. Complete sets from 1891 at $15.00 per volume, plus transportation.

Journal of General Psychology

EDITED BY
CARL MURCHISON

Quarterly, published in January, April, July, and October. Devoted primarily to experimental, theoretical, clinical, and historical psychology. Manuscripts may be sent to any member of the Editorial Board, or may be sent directly to the general editorial office. All subscriptions and business communications should be sent directly to The Journal Press. Two volumes annually. Beginning with 1961, per annum, $20.00; per volume, $15.00; single numbers $7.50. Complete sets from 1927 at $15.00 per volume, plus transportation.

Journal of Social Psychology

EDITED BY
CARL MURCHISON

Bimonthly, published in February, April, June, August, October, and December. National, group, cultural, racial, and differential psychology. Manuscripts may be sent to any member of the Editorial Board, or may be sent directly to the general editorial office. All subscriptions and business communications should be sent directly to The Journal Press. Beginning with 1961, bimonthly, three volumes per year; per annum $30.00; per volume, $15.00; single numbers, $7.50. First number is dated February, 1930. Complete sets from 1930 at $15.00 per volume, plus transportation.

Each author will receive 100 unbound reprints gratis. Additional reprints may be purchased at a nominal cost when the author returns page-proof.

THE JOURNAL PRESS
2 Commercial Street
Provincetown, Massachusetts
U. S. A.

Club Rate For Five International Psychological Journals

(BEGINNING WITH 1961)

	PER ANNUM
THE JOURNAL OF GENETIC PSYCHOLOGY (Quarterly, two volumes per year)	$20.00
GENETIC PSYCHOLOGY MONOGRAPHS (Quarterly, two volumes per year)	$20.00
THE JOURNAL OF GENERAL PSYCHOLOGY (Quarterly, two volumes per year)	$20.00
THE JOURNAL OF SOCIAL PSYCHOLOGY (Bimonthly, three volumes per year)	$30.00
THE JOURNAL OF PSYCHOLOGY (Quarterly, two volumes per year)	$20.00
TOTAL	$110.00
TEACHERS AND STUDENTS EDITION, *Restricted Sale*	$30.00

The *Teachers and Students Edition* is open to any individual psychologist, teacher, student, or physician but requires an agreement that the edition will not be offered for sale till after five years from publication and an agreement that the edition will not be substituted for an institutional subscription.

The *"Small-Library" Edition* is discontinued.

THE JOURNAL PRESS

2 Commercial Street

Provincetown, Massachusetts

U. S. A.

Genetic Psychology Monographs

EDITED BY

CARL MURCHISON

Quarterly: February, May, August, November. Two volumes per year. Child behavior, animal behavior, and the problems of aging. Each number one or more complete researches. Manuscripts may be sent to any member of the Editorial Board, or may be sent directly to the general editorial office. All subscriptions and business communications should be sent directly to The Journal Press. Two volumes annually. Beginning with 1961, per annum, $20.00; per volume, $15.00; single numbers, $7.50. Complete sets from 1926 at $15.00 per volume, plus transportation.

NOTICE. Once more we offer free publication for certain selected monographs. Authors will be charged for cuts and expensive tables, but there will be no page charge for the first 50 pages. For all pages above 50 there will be a charge of $10.00 per page. Two hundred reprints of each monograph will be supplied free of charge, but there will be nominal charges for such things as vitas, special covers, or special title pages.

Genetic Psychology Monographs *(continued)*

VOLUME 1—1926

1. Performance tests for children of pre-school age—R. Stutsman
2. An experimental study of the eidetic type—H. Klüver
3 & 4. A study of natio-racial mental differences—N. D. M. Hirsch
5. A psychological study of juvenile delinquency by group methods—J. W. Bridges and K. M. B. Bridges
6. The influence of puberty praecox on mental growth—A. Gesell

VOLUME 2—1927

1 & 2. The mind of a gorilla—R. M. Yerkes
3. The role of eye-muscles in the expression of the emotions—K. Dunlap
4. Family similarities in mental-test abilities—R. H. Willoughby
5. Coördination in the locomotion of infants—L. H. Burnside
6. The mind of a gorilla: Part II. Mental development—R. M. Yerkes

VOLUME 3—January-June, 1928

1. An experimental study of the olfactory sensitivity of the white rat—J. R. Liggett
2. A photographic study of eye movements in reading formulae—M. A. Tinker
3. An experimental study of the East Kentucky mountaineers—N. D. M. Hirsch
4. Responses of foetal guinea pigs prematurely delivered—G. T. Avery
5. Objective differentiation between three groups in education (teachers, research workers, and administration)—M. B. Jensen
6. The effect of segregation on the sex behavior of the white rat as measured by the obstruction method—M. Jenkins

VOLUME 4—July-December, 1928

1. Observation and training in the fundamental habits in young children—E. A. Bott, W. E. Blatz, N. Chant, and H. Bott
2 & 3. Determination of a content of the course in literature of a suitable difficulty for junior and senior high school students—M. C. Burch
4 & 5. Methods for diagnosis and treatment of cases of reading disability—M. Monroe (*foreword by Samuel T. Orton*)
6. The relative effectiveness of lecture and individual reading as methods of college teaching—E. B. Greene

VOLUME 5—January-June, 1929

1. The age factor in animal learning: I. Rats in the problem box and the maze—C. P. Stone
2. The effect of delayed incentive on the hunger drive in the white rat—E. L. Hamilton
3. Which hand is the eye of the blind?—J. M. Smith
4. The effect of attitude on free word association-time—A. G. Ekdahl
5. The localization of tactual space: A study of average and constant errors under different types of localization—L. E. Cole
6. The effect of gonadectomy, vasotomy, and injection of placental and orchic extracts on the sex behavior of the white rat—H. Thomson

VOLUME 6—July-December, 1929

1. Learning and growth in identical infant twins: An experimental study by the method of co-twin control—A. Gesell and H. W. Nissen
2. The age factor in animal learning: II. Rats in a multiple light discrimination box and a difficult maze—C. P. Stone
3. The acquisition and interference of motor habits in young children—E. McGinnis
4. A vocational and socio-educational survey of graduates and non-graduates of small high schools of New England—A. D. Mueller
5 & 6. A study of the smiling and laughing of infants in the first year of life—R. W. Washburn

VOLUME 7—January-June, 1930

1. Tensions and emotional factors in reaction—E. Duffy
2. Teacher influence on class achievement: A study of the relationship of estimated teaching ability to pupil achievement in reading and arithmetic—H. R. Taylor
3 & 4. A study of the effect of inverted retinal stimulation upon spatially coördinated behavior—P. H. Ewert
5. Mental development of children with lesion of the central nervous system—E. Lord
6. An experimental study upon three hundred school children over a six-year period—N. D. M. Hirsch

VOLUME 8—July-December, 1930

1. The amount and nature of activities of newborn infants under constant external stimulating conditions during the first ten days of life—O. C. Irwin
2. Race and social differences in performance tests—S. D. Porteus, D. M. Dewey, and R. G. Bernreuter
3. Language and growth: The relative efficacy of early and deferred vocabulary training—L. C. Strayer
4. Eye-movements and optic nystagmus in early infancy—J. M. McGinnis
5 & 6. Reactions of kindergarten, first-, and second-grade children to constructive play materials—L. Farwell

VOLUME 9—January-June, 1931

1 & 2. The status of the first-born with a special reference to intelligence—H. H. Hsiao
3 & 4. An experimental study of bright, average and dull children at the four-year mental level—H. P. Davidson
5. An historical, critical, and experimental study of the Seashore-Kwalwasser test battery—P. R. Farnsworth
6. A comparison of difficulty and improvement in the learning of bright and dull children in reproducing a descriptive selection—F. T. Wilson

VOLUME 10—July-December, 1931

1. A comparative study of a group of southern white and negro infants—M. B. McGraw
2 & 3. An experimental study of prehension in infants by means of systematic cinema records—H. M. Halverson
4. The limits of learning ability in kittens—A. M. Shuey
5 & 6. The effect of habit interference upon performance in maze learning—O. W. Alm

VOLUME 11—January-June, 1932

1. General factors in transfer of training in the white rat—T. A. Jackson
2. The effect of color on visual apprehension and perception—M. A. Tinker
3. The reliability and validity of maze experiments with white rats—R. Leeper
4. A critical study of two lists of best books for children—F. K. Shuttleworth
5 & 6. Measuring human energy cost in industry: A general guide to the literature—R. M. Page

VOLUME 12—July-December, 1932

1. Family resemblances in verbal and numerical abilities—H. D. Carter
2. The development of fine prehension in infancy—B. M. Castner
3 & 4. The growth of adaptive behavior in infants: An experimental study at seven age levels—H. M. Richardson
5 & 6. Differential reactions to taste and temperature stimuli in newborn infants—K. Jensen

VOLUME 13—January-June, 1933

1. A critique of sublimation in males: A study of forty superior single men—W. S. Taylor
2. A study of the nature, measurement, and determination of hand preference—H. L. Koch, *et al.*
3. The growth and decline of intelligence—H. E. Jones and H. S. Conrad
4. The relation between the complexity of the habit to be acquired and the form of the learning curve in young children—M. L. Mattson
5. Eating habits in relation to personality developments in two-, and three-year-old children: A study of sixty-nine children in two nursery schools—A. A. Eliot
6. Coördinating mechanisms of the spinal cord—O. C. Ingebritsen

Genetic Psychology Monographs *(continued)*

VOLUME 14—July-December, 1933

1. Mental growth during the first three years: A developmental study of sixty-one children by repeated tests—N. Bayley
2. A study of triplets: including theories of their possible genetic relationships—F. N. Anderson and N. V. Schiedemann
3. The objective measurement of emotional reactions—H. V. Gaskill
4. Development of behavior in the fetal cat—J. D. Coronios
5. A study of certain language development of children in grades four to twelve, inclusive—L. L. LaBrant
6. The effect of early delayed practice in memory and motor performance studied by the method of co-twin control—J. R. Hilgrad

VOLUME 15—January-June, 1934

1. Studies in the psychology of tone and music—P. R. Farnsworth
2. Motor learning of children in equilibrium in relation to nutrition—E. L. Beebe
3. Discrimination limens of pattern and size in the goldfish *Carassius auratus*—J. B. Rowley
4. Limits of learning in the white rat and the guinea pig—E. F. Riess
5 & 6. The limits of learning ability in rhesus monkeys—H. A. Fjeld

VOLUME 16—July-December, 1934

1. A statistical study of ratings on the California behavior inventory for nursery school children—H. S. Conrad
2. An eye-movement study of objective examination questions—A. Frandsen
3. An experimental study of constitutional types—O. Klineberg, S. E. Asch, and H. Block
4. The development of a battery of objective group tests of manual laterality with the results of their application to 1,300 children—W. N. Durost
5 & 6. An experimental study in the prenatal guinea-pig of the origin and development of reflexes and patterns of behavior in relation to the stimulations of specific receptor areas during the period of active fetal life—L. Carmichael

VOLUME 17—January-December, 1935

1. Organization of behavior in the Albino rat—R. L. Thorndike
2. Brightness discrimination in the rhesus monkey—M. P. Crawford
3. The limits of learning ability in cebus monkeys—A. M. Koch
4. Nature-nurture and intelligence—A. M. Leamy
5. On intelligence of epileptic children—E. B. Sullivan and L. Gahagan
6. A study of the play of preschool children by an unobserved observer—D. L. Cockerel

VOLUME 18—January-December, 1936

1. Sex differences in ariational tendency—Q. McNemar and L. M. Terman
2. The process of learning to dress among nursery-school children—C. B. Key, M. R. White, A. B. Hieney, M. P. Honzik, and D. Erwin
3. A study of the present social status of a group of adults who, when they were in the elementary schools, were classified as mentally deficient—W. Baller
4. The influence of specific experience upon mental organizations—A. Anastasi
5 & 6. Studies in aggressiveness—L. Bender, S. Kriser, and P. Schilder

VOLUME 19—January-December, 1937

1. Psychological bases of self-mutilation—C. Dabrowski
2. Masculine temperament and secondary sex characteristics: A study of the relationship between psychological and physical measures of masculinity—H. Gilkinson
3. A psychological study of forty unmarried mothers—R. D Nottingham
4. Behavior problems in the children of psychotic and criminal parents—L. Bender
5. Domination and integration in the social behavior of young children in an experimental play situation—H. H. Anderson
6. The sequential patterning of prone progression in the human infant—L. B. Ames

VOLUME 20—January-December, 1938

1. The relationship between characteristics of personality and physique in adolescents—P. S. de Q. Cabot
2. Behavior problem of elementary school: A description and comparative study—I. Young-Masten
3. Graphic representation of a man by four-year-old children in nine prescribed drawing situations—P. E. Gridley
4. Differences between two groups of adult criminals—R. S. Tolman
5. A comparative study by means of the Rorschach method of personality development in twenty pairs of identical twins—E. Troup
6. Individual differences in the facial expressive behavior of pre-school children: A study by the time-sampling method—C. Swan

VOLUME 21—January-December, 1939

1. An experimental analysis of "level of aspiration"—R. Gould
2. Some light on the problem of bilingualism as found from a study of the progress in mastery of English among preschool children of non-American ancestry in Hawaii—M. E. Smith
3. Domination and social integration in the behavior of kindergarten children and teachers—H. H. Anderson
4. The capacity of the rhesus and cebus monkey and the gibbon to acquire differential response to complex visual stimuli—W. E. Gault
5. The social-sex development of children—E. H. Campbell

VOLUME 22—January-December, 1940

1. Measuring human relations: An introduction to the study of the interaction of individuals—E. D. Chapple
2. Aggressive behavior in young children and children's attitude toward aggression—M. D. Fite
3. Student attitudes toward religion—E. Nelson
4. The prediction of the outcome-on-furlough of dementia praecox patients—J. S. Jacob
5. Significant characteristics of pre-school children as located in Conrad inventory—K. H. Read
6. Learning by children at noon-meal in a nursery school: Ten "good" eaters and ten "poor" eaters—J. B. McCay, E. B. Waring, and P. J. Kruse
7. Studies in the interpretation of play: I. Clinical observation of play disruption in young children—E. H. Erikson

VOLUME 23—January-June, 1941

1. An analysis of certain variables in a developmental study of language—F. M. Young
2. An analysis of the mental factors of various age groups from nine to sixty—B. Balinsky
3. Factors influencing performance on group and individual tests of intelligence: I. Rate of work—M. W. Bennett
4. Individual differences in apperceptive reaction: A study of the response of preschool children to pictures—E. W. Amen

VOLUME 24—July-December, 1941

1. Twins *T* and *C* from infancy to adolescence. A biogenetic study of individual differences by the method of co-twin control—A. Gesell and H. Thompson
2. Finger nail-biting: its incipiency, and amelioration—A. L. Billig
3. An experimental study of the factors of maturation and practice in the behavioral development of the embryo of the frog. *Rana pipiens*—A. Fromme
4. The Fels child behavior scales—T. W. Richards and M. P. Simons
5. Measurement of the size of general English vocabulary through the elementary grades and high school—M. K. Smith
6. Stereotypes in the field of musical eminence—P. R. Farnsworth

VOLUME 25—January-June, 1942

1. A study of factors determining family size in a selected professional group—J. C. Flanagan
2. A genetic study of geometrical-optical illusions—Sister A. Walters
3. Interpretation of behavior-ratings in terms of favorable and unfavorable deviations: A study of scores from the Read Conrad Behavior Inventory—K. H. Read and H. S. Conrad
4. Are there any innate behavior tendencies?—J. B. Schoolland
5. An investigation of the intelligibility of the speech of the deaf—C. V. Hudgins and F. C. Numbers

Genetic Psychology Monographs *(continued)*

VOLUME 26—July-December, 1942

1. The critical frequency limen for visual flicker in children between the ages of 6 and 18—V. L. Miller
   Some factors determining handedness in the white rat—K. L. Wentworth
2. Motivation and behavior—E. Frenkel-Brunswik

VOLUME 27—January-June, 1943

1. Comparison of children's personality traits, attitudes, and intelligence with parental occupation—N. R. Maddy
2. A comparative study of mental functioning patterns of problem and non-problem children seven, eight, and nine years of age—M. L. Pignatelli

VOLUME 28—July-December, 1943

1. Separation anxiety in young children: A study of hospital cases—H. Edelston
2. Correlates of vocational preferences—W. A. Bradley, Jr.

VOLUME 29—January-June, 1944

1. Mental changes after bilateral prefrontal lobotomy—S. D. Porteus and R. D. Kepner
2. A twin-controlled experiment on the learning of auxiliary languages—B. Price. W. J. Kostir, and W. M. Taylor

VOLUME 30—July-December, 1944

1. A method of administering and evaluating the thematic apperception test in group situations—R. M. Clark
2. A study of anxiety reactions in young children by means of a projective technique—R. Temple and E. W. Amen

VOLUME 31—January-June, 1945

1. The evolution of intelligent behavior in rhesus monkeys—B. Weinstein
2. Perceptual behavior of brain-injured, mentally defective children: An experimental study by means of the Rorschach technique—H. Werner

VOLUME 32—July-December, 1945

1. A clinical study of sentiments: I.—H. A. Murray and C. D. Morgan
2. A clinical study of sentiments: II.—H. A. Murray and C. D. Morgan

VOLUME 33—January-June, 1946

1. Interpretation of spontaneous drawings and paintings—T. S. Waehner
   Preference for sex symbols and their personality correlates—K. Franck
2. Outstanding traits in a selected college group—F. L. Wells and W. L. Woods

VOLUME 34—July-December, 1946

1. The relation of emotional adjustment to intellectual function—J. L. Despert and H. O. Pierce
   The smiling response—R. A. Spitz
2. Finger-painting and personality diagnosis—P. J. Napoli

VOLUME 35—January-June, 1947

1. The thematic apperception technique in the study of culture-personality relations—W. E. Henry
2. A continuation study of anxiety reactions in young children by means of a projective technique—M. Dorkey and E. W. Amen
   A study of the vocational interest trends of secondary school and college women—A. M. Cawley

VOLUME 36—July-December, 1947

1. Maze test validation and psychosurgery—S. D. Porteus and H. N. Peters
2. Diagnostic implications of Rorschach's Test in case studies of mental defectives—I. Jolles

VOLUME 37—January-June, 1948

1. The radio daytime serial: A symbolic analysis—W. L. Warner and W. E. Henry
   The relation of personality characteristics and response to verbal approval in a learning task—G. L. Grace
2. The mechanism of vision: XVIII. Effects of destroying the visual "associative areas" of the monkey—K. S. Lashley
   A study of the relationship between handwriting and personality variables—P. Castelnuova-Tedesco

VOLUME 38—July-December, 1948

1. Modern language learning: The intensive course as sponsored by the United States Army, and implications for the undergraduate course of study—M. Lind
   Conflict: A study of some interactions between appetite and aversion in the white rat—M. A. Tolcott
2. A study of certain formal psycho-social aspects of fantasy production in schizophrenia as revealed by performance on the Make a Picture Story (Maps) Test—E. S. Shneidman
   A study of the transmission of authority in the family—H. L. Ingersoll

VOLUME 39—January-June, 1949

1. A study of the psychoanalytic theory of psychosexual development—G. S. Blum
   The assessment of parental attitudes in relation to child adjustment—E. J. Shoben, Jr.
2. Qualitative differences in the vocabulary responses of normals and abnormals—H. Feifel
   The relative effectiveness of motion and still pictures as stimuli for eliciting fantasy stories about adolescent-parent relationship—P. E. Eiserer
   The organization of heredity maze-brightness and maze-dullness—L. V. Searle

VOLUME 40—July-December, 1949

1. An experimental study of what young school children expect from their teachers—B. Biber and C. Lewis
   A study of the relative effects of age and of test difficulty upon factor patterns—H. A. Curtis
   A projective experiment using incomplete stories with multiple choice endings—J. K. Seaton
2. Effects of sex role and social status on the early adolescent personality—E. Milner
   Social perceptions and attitudes of children—M. Radke, H. Trager, and H. Davis

VOLUME 41—January-June, 1950

1. Some psychological and educational aspects of pediatric practice: A study of well-baby clinics—L. H. Blum
   One-trial learning in the domestic rat—B. B. Hudson
   An introduction to the principles of scientific psychoanalysis—A. Ellis
2. Awareness of racial differences by preschool children in Hawaii—D. V. Springer
   Children's evaluation of teacher-approved and teacher-disapproved behavior—S. L. Witryol
   The relationship between level of vocational aspiration and certain personal data—J. Stubbins

VOLUME 42—July-December, 1950

1. Personality patterns of suicidal mental hospital patients—N. L. Farberow
   Sex-role identification in young children in two diverse social groups—M. Rabban
2. A study of the influence of the social field on individual behavior: As revealed in the expression of hostility and warmth by neurotics and paranoid schizophrenics in discussion group situations—D. Shapiro
   An experimental study of avoidance—R. F. Hefferline

VOLUME 43—January-June, 1951

1. A study of copying ability in children—E. A. Townsend
   Prestige motivation of gifted children—D. P. Ausubel
2. A psychological study of physical scientists—A. Roe

VOLUME 44—July-December, 1951

1. The organization of hostility controls in various personality structures—S. Fisher and E. Hinds
   Children and radio: A study of listeners and non-listeners to various types of radio programs in terms of selected ability, attitude, and behavior measures—E. A. Ricciuti
2. Quantitative expression in young children—W. E. Martin
   The use of magnetic devices in the collection and analysis of the preverbal utterances of an infant—A. W. Lynip

VOLUME 45—January-June, 1952

1. Japanese-American personality and acculturation—W. Caudill
2. A statistical study of the Freudian theory of levels of psychosexual development—C. A. Barnes
   Personality characteristics of selected disability groups—D. N. Wiener

Genetic Psychology Monographs *(continued)*

VOLUME 46—July-December, 1952

1. The relationship of social status, intelligence, and sex of 10- and 11-year-old children to an awareness of poverty—F. J. Estvan
   An empirical study of the castration and Oedipus complexes—S. Friedman
2. The relationship between projective test scoring categories and activity preferences—M. M. Schwartz
   A comparison of formal and content factors in the diagnostic testing of schizophrenia—M. Sherman

VOLUME 47—January-June, 1953

1. Ability and accomplishment of persons earlier judged mentally deficient—D. C. Charles
   Variations in the consistency of the behavioral meaning of personality test scores—M. Kornreich
2. Some child-rearing antecedents of aggression and dependency in young children—R. R. Sears, *et al.*
   Symptom correlates for descriptive diagnosis—J. R. Wittenborn, *et al.*

VOLUME 48—July-December, 1953

1. Age and mental abilities: A longitudinal study—W. A. Owens, Jr.
   The development of a personality questionnaire for drinkers—P. J. Hampton
   Personality and physical disease: A test of the Dunbar hypothesis applied to diabetes mellitus and rheumatic fever—D. H. Crowell
2. Socio-economic contrasts in children's peer culture prestige values—B. Pope
   A critical review of the stability of social acceptability scores obtained with the partial-rank-order and the paired-comparison scales—S. A. Witryol and G. G. Thompson
   A study of the effects of color in Rorschach response—G. G. Brody

VOLUME 49—January-June, 1954

1. Factors underlying major reading disabilities at the college level—J. A. Holmes
   Parent behavior toward first and second children—J. K. Lasko
2. Social-status and intelligence: An experimental study of certain cultural determinants of measured intelligence—E. A. Haggard
   Certain determinants and correlates of authoritarianism—S. Siegel
   Personalities in faces: I. An experiment in social perceiving—P. F. Secord, W. F. Dukes and W. Bevan

VOLUME 50—July-December, 1954

1. A study of the relationship between play patterns and anxiety in young children—E. W. Amen and N. Renison
   Operational explorations of the conceptual self system and of the interaction between frames of reference—M. Edelson and A. E. Jones
   Problem solving: A statistical description of some relationships between organismic factors and selected response measures—N. A. Fattu, E. Kapos and E. V. Mech
2. The relation of cortical potentials to perceptual functions—C. Chvatte
   The import for clinical psychology of the use of tests devised from theories about infantile sexuality and adult character—D. W. Miles
   Measuring personality in developmental terms: The P.P.S.—M. H. Krout and J. K. Tabin

VOLUME 51—January-June, 1955

1. Some relations between techniques of feeding and training during infancy and certain behavior in childhood—A. Bernstein
   The expression of personality in drawings and paintings—L. H. Stewart
2. Negative stereotypes concerning Americans among American-born children receiving various types of minority-group education—J. A. Fishman
   The Lincoln-Oseretsky motor development scale—W. Sloan

VOLUME 52—July-December, 1955

1. Some personality correlates of sex, sibling position, and sex of sibling among five- and six-year-old children—H. L. Koch
   A quantitative Rorschach assessment of maladjustment and rigidity in acculturating Japanese Americans—G. Devos
   Measurement of authoritarianism and its relation to teachers' classroom behavior—H. M. McGee
2. The formal aspects of schizophrenic verbal communication—B. Mirin
   A study in an aspect of concept formation with subnormal, average, and superior adolescents—H. N. Hoffman
   Traumatic avoidance learning: Acquisition and extinction in dogs deprived of normal peripheral autonomic function—L. C. Wynne and R. L. Solomon

VOLUME 53—January-June, 1956

1. As the psychiatric aide sees his work and problems—F. L. Wells, M. Greenblatt and R. W. Hyde
   An investigation of avoidance, anxiety, and escape behavior in human subjects as measured by action potentials in muscle—J. D. Brothers
   Spread of effect: A critical review—M. H. Marx
2. Stress, fantasy, and schizophrenia: A study of the adaptive processes—O. J. B. Kerner
   The attitude structure of the individual: A Q-study of the educational attitudes of professors and laymen—F. N. Kerlinger

VOLUME 54—July-December, 1956

1. A study of the personality differences between middle and lower class adolescents: The Szondi Test in culture-personality research—L. Rainwater
   The assessment of parental identification—S. W. Gray and R. Klaus
2. The influence of social context on impulse and control tendencies in preadolescents—C. H. Zuk
   Tender-mindedness versus tough-mindedness in psychology: A reexamination—H. Winthrop
   A method for the comparison of groups: A study in thematic apperception—L. C. Shaw and W. E. Henry

VOLUME 55—January-June, 1957

1. Academic performance and personality adjustments of highly intelligent college students—B. M. Horrall
   The use of the Vineland Social Maturity Scale in the planning of an educational program for non-institutionalized low-grade mentally deficient children—M. G. Gottsegen
2. The structure and origin of the anal character—H. Beloff
   Free expression of adolescents' interests—M. Amatora
   The role of mass media and the effect of aggressive film content upon children's aggressive responses and identification choices—R. S. Albert
   Interest in persons as an aspect of sex difference in the early years—E. W. Goodenough

VOLUME 56—July-December, 1957

1. Some stable response determinants of perception, thinking, and learning: A study based on the analysis of a single test—M. L. Simmel and S. Counts
   Potentials of age: An exploratory field study—S. L. Pressey
2. Tactile communication—L. K. Frank
   The use of a filmed puppet show as a group projective technique for children—M. R. Haworth
   The social competence of middle-aged people—R. J. Havighurst

VOLUME 57—January-June, 1958

1. Psychological and cultural problems in mental subnormality: A review of research—S. B. Sarason and T. Gladwin
2. Developmental aspects of discrimination in relation to adjustment—P. London
   Muscular tension as a response to psychological stress in rheumatoid arthritis and peptic ulcer—J. A. Southworth
   Frustration: Theory and experiment—R. Lawson and M. H. Marx

VOLUME 58—July-December, 1958

1. Emotional aspects of political behavior: The woman voter—E. M. Bennett and H. W. Goodwin
   The accuracy of self estimate: A measure of self-concept reality—R. M. Brandt
   Personality factors in social mobility: A study of occupationally mobile businessmen—J. C. Abegglen
2. Interaction between authoritarian and nonauthoritarian principals and teachers—P. Lambert
   Some factors related to the choice-status of ninety eighth-grade children in a school society—D. Elkins
   Some relationships between fantasy and self-report behavior—R. G. Calogeras

Genetic Psychology Monographs *(continued)*

VOLUME 59—January-June, 1959

1. Freshman Rorschachs and college performance—G. R. Schmeidler, M. J. Nelson, and M. Bristol
   Perceptual aspects of attributed movement—R. W. Coan
   Men and women: Personality patterns and contrasts—E. M. Bennett and L. R. Cohen
2. Personality factors in mothers of cerebral palsied children—G. Boles
   Separatism and integrationism: A social-psychological analysis of editorial content in New York newspapers of three American minority groups—J. A. Fishman and G. S. Fishman
   Self, role, and satisfaction—A. L. Brophy

VOLUME 60—July-December, 1959

1. The constancy of personality ratings over two decades—R. D. Tuddenham
   Mother-son identification and vocational interest—L. H. Stewart
   A study of mother-child relationships in the emotional disorders of children—M. J. Rosenthal, M. Finkelstein, E. Ni, and R. E. Robertson
   On the trail of the wolf-children—W. F. Ogburn and N. K. Bose
2. Measuring the mental health of normal adults—R. F. Peck
   Parental identification in young children—W. Emmerich
   The problems of Jewish religious youth—B. M. Levinson

VOLUME 61—January-June, 1960

1. Identifying socially maladjusted school children—A. A. Adams
   Social interaction in an interracial nursery school—H. W. Stevenson and N. G. Stevenson
   Interests of pre-adolescent boys and girls—M. Amatora
   Educational and sex differences in the organization of abilities in technical and academic students in Colombia, South America—J. F. Filella
2. Some themes in the personalities of German men—L. Rainwater
   Right-left gradients in body image, body reactivity, and perception—S. Fisher
   Longitudinal survey of child Rorschach responses: Younger subjects two to 10 years—L. B. Ames
   Personality patterns related to occupational roles—M. Siegelman and R. F. Peck

VOLUME 62—July-December, 1960

1. The reading process: A descriptive, interdisciplinary approach—M. P. Langman
   Reactions to stress as a function of the level of intelligence—S. M. H. Zaidi
   Rorschach diagnosis by a systematic combining of content, thought process, and determinant scales—P. A. Bower, R. Testin, and A. Roberts
   Longitudinal survey of child Rorschach responses: Older subjects aged 10 to 16 years—L. B. Ames
2. Twenty years of shock therapy in America, 1937-1956: An annotated bibliography—N. H. Pronko, R. Sitterly, and K. Berg
   The quantitative analysis of parent behavior toward psychotic children and their siblings—E. M. Donnelly

VOLUME 63—January-June, 1961

1. Make a sentence test: An approach to objective scoring of sentence completions—E. F. Borgatta
   Some aspects of the relationship between perception and motility in children—E. P. Rothman
   Some psychophysical aspects of mental illness in children—P. H. Berkowitz
   Conceptual thinking in schizophrenic children—G. Friedman
2. Some maternal influences on children's personality and character—J. C. Finney
   A study of concept formation in normals, mental defectives, and brain-damaged adults—R. W. Zaslow
   An investigation of trait relationships among six-year-old children—S. A. Avakian

THE JOURNAL PRESS
2 Commercial Street
Provincetown, Massachusetts
U. S. A.

$20.00 per year
$15.00 per volume
Single Numbers $7.50

QUARTERLY
Two volumes per year

March, 1961
Volume 98, First Half

Founded by G. Stanley Hall in 1891, reorganized by Carl Murchison in 1925

THE JOURNAL OF GENETIC PSYCHOLOGY

Child Behavior, Animal Behavior, and Problems of Aging

If this space should be unstamped, this is the regular library edition. But if this space is stamped with a designating title, this is a special edition, sold under the restrictions of a liberal contract, and may not be resold for a period of five years from the date of publication.

MARCH, 1961

(Manuscripts are printed in the order of final acceptance)

The specificity of children's moral judgments 3
By DOLORES DURKIN

Weight gain as a function of early social experience in the albino rat . . 15
By JOSEPH ROSEN

Characteristics of a psychosexual scale: The Krout Personal Preference Scale 19
By RICHARD A. LITTMAN, LOUIS J. NIDORF, AND NORMAN D. SUNDBERG

Responses of two-year-old children to controlled stress situations . . . 29
By D. BRUCE GARDNER, DAMARIS PEASE, AND GLENN R. HAWKES

The development of quantitative thinking: A systematic replication of Piaget's studies 37
By DAVID ELKIND

(OVER)

Copyright, 1961, by The Journal Press
Provincetown, Massachusetts, U. S. A.

Entered as second-class matter May 11, 1937, at the post-office at Provincetown, Mass., under the Act of March 3, 1879
Second-class postage paid at Provincetown, Mass.

Fluency abilities in preschool children 47
By Carl Bereiter

Strength of secondary reinforcement as a function of the quality of food reward 49
By George W. Lewis and Kenneth M. Michels

Effect of amount and percentage of reinforcement on resistance to extinction in preschool children 55
By Donald K. Pumroy and Shirley S. Pumroy

Student self estimates of final course grades 63
By Eugene L. Gaier

Subcultural values and IQ stability 69
By Boris M. Levinson

Japanese and American children's perception of parents 83
By Misao Matsumoto and Henrietta T. Smith

Individual differences in discrimination learning by cats 89
By J. M. Warren

Group operant behavior: An extension of individual research methodology to a real-life situation 95
By Joseph J. Antonitis and Gerald W. Barnes

Conditional discrimination in rats 113
By Alvin J. North and Patricia Lang

California Test of Mental Maturity *b* weights for predicting a composite score on the Iowa Tests of Educational Development 119
By Russell N. Cassel and Edward J. Stancik

Some indications of muscular armoring in two six-year-old retarded children 127
By Elizabeth W. Badgeley

School interests of early adolescence 133
By Sister Mary Amatora, O. S. F.

Measuring the teacher's effectiveness as a lecturer 147
By Stanley A. Rudin

BOOKS 155

BOOKS RECENTLY PUBLISHED 155

The Journal of Genetic Psychology, 1961, 98, 3-13.

THE SPECIFICITY OF CHILDREN'S MORAL JUDGMENTS*

School of Education, University of California, Berkeley

DOLORES DURKIN

A. INTRODUCTION

In *The Moral Judgment of the Child* (4) Piaget questioned Swiss children about two story-situations depicting acts of physical aggression, and on the basis of their responses he proposed that "children maintain with a conviction that grows with their years that it is strictly fair to give back the blows one has received" (4, p. 301). This increasing acceptance, with age, of reciprocity as a principle of justice assumes importance in Piaget's more general theory of moral-judgment development in children.

The present writer, in an earlier study (1), attempted to evaluate the Piaget proposal regarding children's attitudes toward reciprocity by questioning American children of three different age-groups, also about acts of physical aggression. A story-situation used in that study was as follows:

> (A) One day when they were out at recess, Bennett hit Van.
> What should Van do?
> Why?[1]

As a further evaluation of the general applicability of Piaget's proposal, a second study (2) was made in which the same subjects were questioned about behaviors other than that of physical aggression. Four of the story-situations used in this second study were as follows:

> (B) One morning in school, Anton asked Cyril Hayes, the boy who sits in front of him, if he could use his eraser. Cyril said, "No." About a week later, Cyril was the one who didn't have an eraser, so he asked Anton if he could use his.
> What should Anton do?
> Why?
>
> (C) In another room a boy by the name of Keith took a ruler off Russell Holec's desk and wouldn't give it back to him.
> What should Russell do?
> Why?

* Accepted for publication by Harold E. Jones of the Editorial Board, and received in the Editorial Office on April 16, 1959.

[1] Identical story-situations were presented to male and female subjects. For the female subjects, however, the story characters were always girls; for the male subjects, they were always boys.

(D) One morning in school Basil copied answers from another boy's test paper, and his teacher caught him. Later, when the children were out on the playground at recess time, Alf, a boy in Basil's room, ran up to Basil and called, "Hi, cheater! Hi, cheater!"
What should Basil do?
Why?[2]

(E) On another day Alf was the one who was caught cheating.
What should Basil do?
Why?

A summary of subjects' responses to Stories *A*, *B*, *C*, and *E*, categorized as being reciprocity or non-reciprocity responses, appears in Table 1. Following Piaget's definition of reciprocity as being a return of identical behavior, reciprocity responses for Story *A* are those which propose that if a child is hit by another, he should hit this second child in return. For Story *B*, a reciprocity response is one which proposes that a child should not share his property with a child who has previously refused to share his. Reciprocity responses for Story *C* are those which recommend that a child should take

TABLE 1
FREQUENCY DISTRIBUTION OF TWO KINDS OF RESPONSES AT THREE DIFFERENT GRADE LEVELS

Kind of response	Grade II	Grade V	Grade VIII
Aggressing Another			
Reciprocity	8	15	4
Non-reciprocity	20	23	31
Refusing to Share Property			
Reciprocity	20	15	6
Non-reciprocity	8	23	29
Taking Property			
Reciprocity	2	2	1
Non-reciprocity	26	36	34
Defaming Character			
Reciprocity	14	8	2
Non-reciprocity	14	30	33

the property of another child who has previously taken his; and for Story *E*, reciprocity responses are those which suggest that one child has the right to defame the character of another child if he has previously defamed his.

The primary concern of the two studies described above was the com-

[2] This story was included only to provide background material for Story *E*. Subjects' responses to it were not analyzed, or included in the study.

parison of judgments of American subjects with those of Piaget's Swiss subjects; and, as can be seen in Table 1, their findings did not substantiate Piaget's proposal concerning the child's increasing acceptance, with age, of reciprocity as a principle of justice. Also noted in the findings, however, was the fact that this group of American subjects made quite different kinds of judgments about different kinds of justice-violations. As was indicated in one of the studies, "this phenomenon of specificity would tend to suggest further flaw in the Piaget theory in that the theory purports to describe the development of children's attitudes toward reciprocity on the basis of their judgments about a single kind of behavior, that of physical aggression" (2, p. 295).

The purpose of the present study, therefore, is twofold: (*a*) to examine systematically the specificity of judgments made by this American group of subjects, and (*b*) to examine the reasons they give for their judgments as a way of possibly explaining the specificity.

B. Subjects and Procedure

The 101 subjects in this study were all of the second-, fifth-, and eighth-grade children in a Midwestern community-consolidated school. Twenty-eight of the total group were in Grade II, 38 were in Grade V, and the remaining 35 were in Grade VIII. These particular grade-levels were selected because in them it would be most likely to find chronological ages of seven, 10, and 13, the age-groups that correspond to what Piaget designates as "three great periods in the development of the sense of justice in the child" (4, p. 314). The actual mean ages of the three groups were 7.8, 10.9, and 13.9.

As was described in detail in an earlier study (1), subjects' responses to the story-situations were obtained in individual, tape-recorded interviews.

C. Findings

1. *Specificity of Responses*

The specificity of subjects' responses can be examined on the basis of their responses as a group, and as individuals. Group responses have been summarized in Table 1, and they show that reciprocity responses were given by 26.7 per cent (SE = 4.2) of the subjects to Story *A*, by 40.6 per cent (SE = 4.9) of the subjects to Story *B*, by 5.0 per cent (SE = 2.2) of the subjects to Story *C*, and by 25.7 per cent (SE = 4.4) of the subjects to Story *E*. Remaining responses were of a non-reciprocity kind.

These differences in group responses to the four stories, in terms of their

being reciprocity or non-reciprocity responses, were examined for significance by use of chi square tests for correlated percentages (3). Chi square values, corrected for continuity, appear in Table 2. As the table shows, group responses to the four stories, taking the stories two at a time, are, with one exception (responses to Stories *A* and *E*), significantly different.

TABLE 2
VALUES OF CHI SQUARE IN TESTS OF THE SIGNIFICANCE OF DIFFERENCES IN SUBJECTS' RESPONSES TO FOUR DIFFERENT STORIES

Stories compared	Value of chi square	Significance level
A and B	4.69	$p < .05$
A and C	18.37	$p < .01$
A and E	0.00	$p > .99$
B and C	32.23	$p < .01$
B and E	6.32	$p < .02$
C and E	16.00	$p < .01$

Specificity on the basis of individual responses is shown in Table 3 where it can be seen that of the 27 reciprocity responses given to Story *A*, that depicting physical aggression, two or 7.4 per cent ($SE = 5.0$) accurately predict a subject's response to the three subsequent stories in terms of their being either reciprocity or non-reciprocity responses (Pattern 1). It can

TABLE 3
FREQUENCY DISTRIBUTION OF SIXTEEN POSSIBLE PATTERNS OF RESPONSE AT THREE DIFFERENT GRADE LEVELS

Sixteen possible patterns of reciprocity and non-reciprocity responses to the four stories	Grade II	Grade V	Grade VIII
1. R, R, R, R	1	1	0
2. N-R, N-R, N-R, N-R	4	14	26
3. R, N-R, N-R, N-R	0	6	1
4. R, R, N-R, N-R	1	4	1
5. R, R, R, N-R	0	0	1
6. N-R, R, R, R	1	0	0
7. N-R, N-R, R, R	0	0	0
8. N-R, N-R, N-R, R	3	1	1
9. N-R, R, N-R, R	4	3	1
10. R, N-R, R, N-R	0	1	0
11. N-R, R, R, N-R	0	0	0
12. R, N-R, N-R, R	1	1	1
13. N-R, R, N-R, N-R	8	5	3
14. R, N-R, R, R	0	0	0
15. R, R, N-R, R	5	2	0
16. N-R, N-R, R, N-R	0	0	0

also be seen from Table 3 that of the 74 non-reciprocity responses given by subjects to Story *A*, 44 or 54.5 per cent (SE = 5.8) accurately predict an individual's responses to the three subsequent stories (Pattern 2).

In order to examine statistically the independence of a subject's response to Story *A* and to each of the other three stories, chi square tests of contingency were carried out (3). The values of chi square, corrected for continuity, appear in Table 4. As this table indicates, hypotheses of independence cannot be rejected at the five per cent level of confidence, the criterion of significance used throughout this paper.

TABLE 4
VALUES OF CHI SQUARE IN TESTS OF INDEPENDENCE OF A SUBJECT'S RESPONSE TO STORY A AND TO STORIES B, C AND E

Stories compared	Value of chi square	Significance level
Grade II		
A and B	0.53	$.30 < p < .50$
A and C	0.01	$.90 < p < .95$
A and E	3.44	$.05 < p < .10$
Grade V		
A and B	1.37	$.20 < p < .30$
A and C	0.55	$.30 < p < .50$
A and E	0.08	$.70 < p < .80$
Grade VIII		
A and B	1.32	$.20 < p < .30$
A and C	1.51	$.20 < p < .30$
A and E	0.09	$.70 < p < .80$

2. *Reasons Given for Responses*

a. Story A (Aggressing another). A frequently noted characteristic of the reasons given by subjects for their responses to Story *A* was the element of negativism; that is, subjects seemed to arrive at their particular judgments more by elimination than by direct choice. Such a tendency, it was further noted, was one which significantly increased as grade-level increased ($X^2 = 11.9$; $p < .01$). Specifically, negativism characterized the reasons given by four or 14.3 per cent (SE = 6.6) of the second graders, by 13 or 34.2 per cent (SE = 7.7) of the fifth graders, and by 24 or 63.2 per cent (SE = 8.2) of the eighth graders.

Of the four second-grade subjects who seemed to take this negative approach in solving the problem, three explained their particular responses by denouncing reciprocity ("He shouldn't hit him back."); the fourth, by denouncing the telling of a teacher about the offense. Ten of the 13 fifth

graders gave as reasons for their responses a denouncement of reciprocity, while the other three explained, "He shouldn't tell." Of the 24 eighth-grade subjects in this group of "negativists," 21 objected to reciprocity, two objected to telling a teacher, and one objected to both reciprocity and telling a teacher.

Summarily, 41 or 40.6 per cent (SE = 4.9) of the total group of subjects explained their responses to Story *A* by denouncing other possible responses. Thirty-four in this group objected to reciprocity, six objected to telling an authority person, and one objected to both reciprocity and "telling."

A second characteristic noted in the reasons given by subjects for their particular responses to Story *A* was a lack of articulation, a characteristic which decreased significantly as grade-level increased ($X^2 = 19.09$; $p < .01$). When probed as to why a particular response was given, 16 or 57.1 per cent (SE = 9.4) of the second-grade subjects, and 11 or 28.9 per cent (SE = 7.4) of the fifth-grade subjects could give no further or more articulated reason than, "Because he hit him."

b. Story B (Sharing property). All of the reasons given by the 41 subjects who suggested reciprocity as a solution for Story *B* (see Table 1) were identical in essence: One shouldn't share property with a child who has previously refused to share his. Typical of the specific reasons given were:

> "'Cause he said no the other time."
> "That other boy never let him have nothing."
> "Because the other boy said no, and he might have had to use it real bad."
> "Because the boy wouldn't let him use his eraser, so there's no reason why he should let him use his."

While it would seem, on the surface, that non-reciprocity responses—that is, responses that proposed sharing—would be more altruistic kinds of responses, examination of the reasons given for some of them suggested, actually, a regard for one's own rather than for one's neighbor's needs. Of the 60 non-reciprocity responses given to Story *B* (see Table 1), none given by the second graders, but 10 or 43.5 per cent (SE = 10.3) of those given by the fifth graders, and 12 or 41.4 per cent (SE = 9.2) of those given by the eighth graders were explained in terms of looking out for one's own future needs. These 22 subjects suggested, for example, that one should share an eraser with a child who has previously refused to share his because:

> "Maybe the other boy would feel ashamed of himself and give it to him the next time."

"The other boy would be more apt to loan his the next time."
"He can say, 'The next time I don't have an eraser you can let me use yours'."

More altruistic kinds of reasons were given by the other 38 subjects who also gave non-reciprocity responses to Story B. Typical of these were:

"Because it's nicer to share with other people."
"Because you should let people borrow things."
"To be nice about the deal."
"Because it would be kind if he let him borrow it."
"He should be nice instead of stingy."

c. Story C (Taking property). As Table 1 shows, only five subjects or 5.0 per cent (SE = 2.2) of the total group of 101 subjects gave reciprocity responses to Story *C*. Each of the five explained his response by pointing out that if a child takes a ruler belonging to another child, the second child has the right to take something of his. Only one of these subjects (a second grader) specified it should be another ruler.

Eighty-nine or 92.7 per cent (SE = 2.7) of the 96 non-reciprocity responses given to Story *C* suggested telling an authority person about the child who has taken property belonging to another; for all but one, the authority person was the teacher.[3] Three different kinds of reasons were given by the 89 subjects for this non-reciprocity response. Twenty-nine (8 in Grade II, 5 in Grade V, 16 in Grade VIII) identified the behavior described in Story *C* as stealing which, they suggested, should be reported to an authority person. Fifty-three (15 in Grade II, 27 in Grade V, 11 in Grade VIII) saw telling an authority person as a way of getting back the property that had been taken. The remaining seven subjects (1 in Grade V, 6 in Grade VIII) saw telling an authority person as a way of avoiding trouble. As one of the seven explained, "If he tried to take it away, he might get into trouble for fighting."

d. Story E (Defaming character). Of the 24 reciprocity responses given to Story *E* (see Table 1), 22 or 91.7 per cent (SE = 5.6) were explained by subjects' apparent acceptance of the principle, "Do unto others as they do unto you." Or, as they specifically put it:

"You've got to take your own part. When somebody does something you got to do it back."
"He did it to him, so he should do it to get even with him."

---

[3] One subject suggested telling a policeman about the offense. School records showed that her father was serving time in a penitentiary for forgery.

Reasons given for the other two reciprocity responses were:

"To show him that your feelings can be hurt by somebody calling you a cheater."

"To prove he wasn't the only one who ever copied."

The 77 non-reciprocity responses to Story *E* (see Table 1) were actually "Do nothing" responses; that is, subjects proposed that a child who has been called a "cheater" by another child should do nothing when, subsequently, the second child is found to be cheating. Fifty-two or 67.5 per cent (SE = 5.3) of such responses were explained in terms of a denouncement of reciprocal behavior, and for these 52 subjects reciprocal behavior was to be avoided because:

It is wrong to tell bad things about another (N = 17).
It would hurt the child's feelings (N = 9).
It would make him lose his friends (N = 7).
It would lead to further trouble (N = 7).
Two wrongs don't make a right (N = 5).
It is the behavior of a tattle-tale (N = 4).
It would anger the child (N = 1).
It would lead to his seeking revenge (N = 1).
It would ruin his reputation (N = 1).

The other 25 subjects in this group of 77 explained their non-reciprocity responses directly; that is, without any reference to reciprocal behavior. Nine of them referred to and applied the Golden Rule; eight referred to the future by prophesying that if Basil said nothing now, Alf wouldn't say anything if Basil were caught cheating a second time. Seven other subjects maintained that Basil should do nothing because what Alf did was none of his business, while the final subject explained:

"In the Bible it says that if you be kind to people even when they do something to you, you'll even the score. . . . Like if he hit you on the cheek and you turn your head the other way . . . that would even the score because that would hurt him. . . . He'd feel sorry and stuff like that."

D. Discussion

The specificity of children's moral judgments, and in particular of their attitudes toward reciprocity as a principle of justice, has been noted in a general way in a previous study (2). Now, when analyzed in detail, it becomes even more pronounced and emphatic. Considered as a group, the 101 subjects in this present study were found to make, with one exception, significantly different kinds of judgments about four different kinds of

behavior. The exception occurred (see Table 2) when their responses to Story *A* (Aggressing another) and Story *E* (Defaming character) were compared. Considered as individuals, their judgments about one kind of behavior (physical aggression) were shown to be consistently independent of their judgments about three other kinds of behavior (see Table 4). Taken together, then, these findings indicate that a child's judgments about the restoration of right order in various situations is affected by the particulars of each situation; and, therefore, that it cannot be assumed that his judgment about one is necessarily representative of what his judgments about the others would be. As was indicated earlier, this phenomenon of specificity places limitations on the general applicability of Piaget's theory regarding the development of concepts of justice in children since the theory is based on their judgments about the restoration of right order in a single kind of situation, that of physical aggression between children.

Examination of the reasons given by subjects in this present study for their particular judgments, originally proposed as a possible way of explaining the specificity, actually serves better as a way of further emphasizing it. For example, the examination of reasons given for responses to Story *B* (Sharing property) has demonstrated that apparently identical responses are, at a subsurface level, quite different in essence. To share one's property with another child because it would be kind to do so is, it would seem, an essentially different kind of proposal from one that suggests a child should share because it will probably mean material advantages for him in the future. Or, as in Story *E* (Defaming character), the proposal that one child should refrain from defaming the character of another because to do so would hurt his feelings is hardly identical to a proposal that is overtly similar in kind, but which is explained in terms of: Don't tell on him, and he won't tell on you.

These elements of pragmatic concern for one's own future welfare have been seen as especially characteristic of reasons given by subjects for their non-reciprocity responses. As such, they tend to suggest that the apparent altruism and goodness of non-reciprocity responses, as compared with reciprocity responses, are not always substantiated in fact. This important difference between appearance and fact is further emphasized by the observation that certain non-reciprocity responses, when analyzed through the reasons given for them, could actually represent indirect forms of reciprocity. Such a possibility became especially pronounced in the response of the subject who promoted the Biblical ideal of turning one's cheek when hit by another

because, according to his interpretation, it was a way of "getting even." Perhaps, then, the Piaget definition of reciprocity as being a return of identical behavior is too narrow in that it fails to include the more subtle forms of reciprocity.

Reasons given by subjects for their judgments also point to at least two other kinds of incidental, but nonetheless noteworthy observations. That they show, for example, such frequent reference to what shouldn't be done, rather than to what should be done, tends at least to suggest that the negative side of moral codes is being emphasized to such an extent that their positive side lacks existence, or at least clarity and preciseness for some children. Frequently, in this study, subjects' responses would prompt one to say, "I know what you're against, but what are you for?" And they would also suggest, as was indicated above, that there is a real need to add positive substance to children's moral ideals.

The second incidental observation made regarding reasons given by subjects for their judgments was their lack of articulation. As was indicated earlier, some of the younger subjects were able to give, as the reason for their judgments, only a verbal repetition of the behavior depicted in the story being considered. Actually, this same kind of tendency among younger children has also been noted in Strauss' (5) study of the development of conceptions of rules. He calls it a definitional conception of rules, and explains that "If a consequence is envisaged (by younger children), it . . . follows by definition, by a kind of direct connection between infraction and consequence that is grounded in no other rationale than its own connection" (5, p. 195). While data in this present study are not sufficient to verify such a proposal, nonetheless they do not contradict it. Perhaps other studies, in the light of the importance of reasons given by children for moral judgments, would do well to focus on them with both persistence and depth.

E. Summary and Conclusions

The major purpose of this study was to examine the specificity of children's moral judgments, and in particular of their attitudes toward reciprocity as a principle of justice. Four story-situations, depicting various behaviors, were presented to 101 subjects of three different age-groups; each, in turn, was questioned about them. Their responses, and the reasons they gave for them, were then examined in detail. This analysis showed that:

1. Considered as a group, subjects' responses to the four stories were, with one exception, significantly different in kind.

2. Considered as individuals, their responses to the four stories were, found to be consistently independent of each other.

3. Reasons given by subjects for their responses were found, in some instances, to alter the apparent nature of such responses. It was thus demonstrated that responses overtly identical can be, when analyzed through the reasons given for them, essentially different in kind.

4. Reasons given by subjects for their responses also suggested, in some instances, the possibility that a definition of reciprocity as being a return of identical behavior is too narrow in that it fails to include the more subtle forms of reciprocity.

References

1. Durkin, D. Children's concepts of justice: a comparison with the Piaget data. *Child Devel.*, 1959, **30**, 59-67.
2. ———. Children's acceptance of reciprocity as a justice-principle. *Child Devel.*, 1959, **30**, 289-296.
3. Edwards, A. L. Experimental Design in Psychological Research. New York: Rinehart, 1950.
4. Piaget, J. The Moral Judgment of the Child. London: Harcourt, Brace, 1932.
5. Strauss, A. L. The development of conceptions of rules in children. *Child Devel.*, 1954, **25**, 193-208.

Department of Curriculum and Teaching
Teachers College
Columbia University
New York 27, New York

The Journal of Genetic Psychology, 1961, 98, 15-17.

WEIGHT GAIN AS A FUNCTION OF EARLY SOCIAL EXPERIENCE IN THE ALBINO RAT*

Department of Psychology, University of Toronto

JOSEPH ROSEN

A. PROBLEM

This constitutes a preliminary investigation into the relationship between early social experience and weight gain in the rat. Social experience is defined in terms of group versus solitary living. Seitz (5) found that male rats reared in small litters during infancy were significantly heavier than large-litter ones. Christian (2) kept albino mice in populations of 1, 4, 8, 16, and 32 mice per cage for a period of one week. He found a decline in mean body weight as the population increased from one to four mice per cage. The variation in weight with population size was not significant. However, Christian did not institute the group living experience until three weeks after weaning. In a recent review, King (3) has emphasized the importance of further investigation of the two parameters of age of onset of early experience and duration of experience. This suggests that a significant difference in weight might be obtained by initiating treatment earlier in the life history of the rat and by prolonging the duration of the experience.

The specific hypothesis tested was that male rats living in groups of two for three weeks following weaning would be significantly lighter than rats living alone.

B. METHOD

Twenty-four male albino rats (Wistar strain) obtained at age 21 days were randomly divided into two groups of 12 *S*s. All *S*s were weighed immediately following assignment to their respective groups. The experimental *S*s (group living) were housed in groups of two each for three weeks following weaning in 12 in. × 11 in. × 10 in. metal living cages. The grouping of *S*s was randomized. The control *S*s (solitary living) were housed individually in identical cages. The placement of cages on the racks was also randomized. The *S*s were maintained on an *ad libitum* diet of water and Master Fox Chow cubes. Ventilation was controlled by a blower system, and the temperature was held constant at 78° F. All *S*s were weighed again at age 42 days. *S*s received no handling except for initial and final weighing.

* Received in the Editorial Office on April 23, 1959.

C. Results

The initial and final mean body weights and SD's of the group and solitary living *Ss* are shown in Table 1.

TABLE 1
INITIAL AND FINAL MEANS AND STANDARD DEVIATIONS OF WEIGHTS FOR GROUP LIVING (GL) AND SOLITARY LIVING (SL) GROUPS

Group	N	Initial Mean weight (gm)	SD	Final Mean weight	SD
GL	12	44.75	4.55	155.50	5.51
SL	12	43.92	4.09	161.58	4.09

The solitary living rats were heavier at age 42 days than the group living ones, although the latter were slightly heavier at age 21 days. The difference between the final group means is not significant ($t = .929$; $df = 22$).

D. Discussion

This study shows no significant difference in mean body weight between male albino rats raised in groups of two for three weeks following weaning and those raised individually. However, these results are in accord with those obtained by Christian (2) in that the weight of the solitary-living *Ss* at age 42 days was greater than that of the group living rats. Christian has suggested that stress is produced "in the individuals of a mammalian population in proportion to the population density" (p. 292). Increases in population size should lead to increases in the production of a density-dependent stress reaction. The exact nature of the social pressures arising from increases in population size are still undetermined. The possibility of an increase in the density-dependent stress reaction due to competition for food and water among the group living rats is untenable as both were maintained in excess.

The findings of this investigation suggest the need for further research into the relationship between this form of social experience and weight gain in the rat. This might take the form of using groups of greater population size and by prolonging the duration of the group living experience.

There is another aspect of these findings that deserve comment. It has been shown by some investigators (1, 4, 6) that male albino rats receiving tactual stimulation in the form of gentling or handling for three weeks following weaning are significantly heavier than ungentled rats. Now rats living in groups of two for this duration of time presumably receive more

tactual stimulation through playing, fighting, and sleeping together than solitary living animals. Yet this study shows that the group living animals were lighter at final weighing than the controls, although the former were heavier at initial weighing. Although the daily stroking by a psychologist's finger cannot be equated with this form of sensory stimulation, it does raise some interesting questions as to what factor is operating in the many "gentling" studies published to date.

E. Summary

This study was concerned with the relationship between early social experience in the form of group versus solitary living and weight gain in the rat. Solitary-living rats were not significantly heavier than male albino rats living in groups of two for three weeks following weaning. Results were discussed in terms of Christian's hypothesis concerning the relationship between increases in population size and increases in the density-dependent stress reaction. Recommendations for further research were outlined in terms of using larger populations and prolonging the group living period.

References

1. Brooker, H. The effect of the amount of early handling on weight gain in the albino rat. Unpublished master's thesis, Univ. Toronto, 1955.
2. Christian, J. J. Effect of population size on the adrenal glands and reproductive organs of male mice in populations of fixed size. *Amer. J. Physiol.*, 1955, **182**, 292-300.
3. King, J. A. Parameters relevant to determining the effect of early experience upon the adult behavior of animals. *Psych. Bull.*, 1958, **55**, 46-58.
4. McClelland, W. J. Differential handling and weight gain in the albino rat. *Can. J. Psychol.*, 1956, **10**, 19-22.
5. Seitz, P. F. D. The effects of infantile experiences upon adult behavior in animal subjects: I. Effects of litter size during infancy upon adult behavior in the rat. *Amer. J. Psychiat.*, 1954, **110**, 916-927.
6. Weininger, O. The effects of early experience on behavior and growth characteristics. *J. Comp. & Physiol. Psychol.*, 1956, **49**, 1-9.

Roscoe B. Jackson Memorial Laboratory
Hamilton Station
P.O. Box 847
Bar Harbor, Maine

The Journal of Genetic Psychology, 1961, 98, 19-27.

CHARACTERISTICS OF A PSYCHOSEXUAL SCALE: THE KROUT PERSONAL PREFERENCE SCALE*

Departments of Psychology, University of Oregon and Clark University

RICHARD A. LITTMAN, LOUIS J. NIDORF, AND NORMAN D. SUNDBERG[1,2]

A. PROBLEM

The psychoanalytic theory of psychosexual development has played a very important role in psychological research during the past two decades. Because of the economies to be gained it would be very desirable to develop a simpler and more objective means than the interview for assessing psychosexual levels. Blum's Blacky Test is a projective approach to the problem. Another approach is the questionnaire test by Krout and Krout (2), and Krout, Tabin, and Krout (3), a scale consisting of 10 subscales of 10 items each. Each item is chosen for its symbolic value, e.g., "sleeping curled up" or "sound of a tuba" to which the subject responds "like," "dislike," or "indifferent." The present paper reports the results of a study of the Krout Personal Preference Scale with respect to the following: (*a*) norm patterns for different subgroups; (*b*) the relationships among subtests; and (*c*) some considerations of the theoretical or *a priori* characteristics of the scale.

The present study is based upon the second edition of the scale. For that reason we shall not be able to draw direct comparisons between our results and those of Stagner and his co-workers (7, 8) who investigated the first edition. Stagner himself raises questions in a footnote (8) about the applicability of his findings to the new edition. However, our results do suggest some comparisons. For example, though we did not do a factor analysis, the relationships we found suggest that the unities hypothesized by Krout do not exist. Also, our study implies agreement with the conclusions from Stagner and Moffitt's second study (8) that negative findings are likely to be attributable to defects in the KPPS and that it is unlikely that analytic theory is actually being tested properly.

* Received in the Editorial Office on May 7, 1959.

1 The present report is based upon the analysis carried out by Mr. Nidorf for a thesis at the University of Oregon (1956). It is on file in the Library of the University of Oregon.

2 We are greatly indebted to the E. C. Brown Trust and its director, Mr. Curtis E. Avery, for a grant to study various aspects of personality development. The data reported here are a portion of the results obtained under the grant.

B. Procedure

Subjects for the present report were drawn from five classes in general psychology at the University of Oregon during the 1954-1955 school year. Of the 321 subjects who composed the final sample, 181 were male and 140 were female. The great majority were college sophomores. The students took the KPPS along with a personal history questionnaire which is described below and two standard personality questionnaires which are not reported here. Scoring of responses followed Krout's standard procedure.

C. Results

Table 1 shows the results of several comparisons. The means and standard deviations of the Oregon sample are listed. The appended symbols indicate the significant differences between the Oregon sample and the Krout samples, using *t* tests for difference between means and *F* tests for variance differences. Oregon males and the Oregon females were compared with two like-sex Krout samples—the unselected samples with *N* of 300 and the psychology student samples with an *N* of 50 each. In comparison with the Krout unselected male sample, the Oregon male means were higher on I, VI, and VIII and lower on VII and IX; in comparison with the Krout male psychology students Oregon male means were higher on II and IX. In comparison with the Krout unselected female sample, Oregon female means were higher on I, II, and VI and lower on IV, V, and X; in comparison with Krout female psychology students, Oregon female means were higher on II and lower on V and X. On several of the subscales difference in variances was also indicated by *F* test.

Table 1 also shows the tests for sex differences on the Oregon sample. Males scored significantly higher than females on IV, V, and VIII and lower on II, VII, and IX. Theoretically one might expect pre-Oedipal materials to be identical for males and females (Munroe, 1955), and therefore would hypothesize that group means for Scales I through V would not be significantly different. Severe differences do occur. In the original study on which this report is based (Nidorf), portions of the Krout data were re-analyzed for male-female differences. For both unselected and psychology student samples significant differences were found on the majority of Subtests I to V.

Table 2 reports the tetrachoric correlation matrix for those subtests which differed significantly by chi-squared tests. It will be seen that 23 out of the 45 male intercorrelations were significant. On the other hand, only

TABLE 1
COMPARISON OF SUBSCALE SCORES FOR OREGON AND KROUT GROUPS

Subscale	Oregon males (N, 181) Mean	SD	Oregon females (N, 140) Mean	SD	Male-female Comparisons F	t
I. Pre-Natal and Natal	12.0[a]	2.6	11.6[a]	2.6[b]	1.02	1.35
II. Oral Incorporative	10.5[b]	3.0	11.2[a,b]	2.9[b]	1.04	2.11[c]
III. Oral Sadistic	11.3	2.6	11.4	2.4	1.13	.35
IV. Anal Expulsive	10.6	2.6	10.0	2.6	1.05	2.04[c]
V. Anal Sadistic	10.7	3.0[a,b]	9.5	2.6	1.32[c]	3.76[c]
VI. Phallic Narcissistic	11.8	3.5	12.1	3.5	1.04	.76
VII. Feminine	5.1	3.4	13.6	3.2	1.14	22.71[c]
VIII. Masculine	14.1	2.7	9.4	3.0	1.21	14.52[c]
IX. Emotional Maturity	9.1	3.6	11.6	3.8	1.14	5.99[c]
X. Social Maturity	10.3	3.2	9.8	2.9	1.24	1.44

[a] Significant below the 5 per cent level, compared with like-sex Krout unselected sample (N, 300) on *t* or *F* tests.

[b] Significant below the 5 per cent level, compared with like-sex Krout psychology student sample (N, 50) on *t* or *F* tests.

[c] Significant below the 5 per cent level in the Oregon male-female comparisons.

7 of the possible 45 intercorrelations were significant for the females. For the males, 10 of the 23 correlations were .40 or above while only 6 were below .30. Three of the 7 significant female correlations were above .40 and only one was below .30. In general, then, there was a substantial amount of intercorrelation in this particular matrix.

TABLE 2
KROUT SUBTEST CORRELATIONS*—OREGON SAMPLE

		Male subtests									
		I	II	III	IV	V	VI	VII	VIII	IX	X
Female subtests	I		.25	.31	.43		.32		.40		
	II			.37			.25				.35
	III					.33	.28		.25	.27	
	IV			.29			.47		.45		
	V								.25		.47
	VI				.34			.43	.43		.48
	VII			.37			.46			.47	.34
	VIII				.41						.30
	IX							.33			.44
	X									.41	

* Estimates of *rt*.

A personal history questionnaire was administered to the subjects. They were asked to give information concerning such things in their early lives as the number of household moves, the time spent away from parents, the most influential people in their lives, and the parent to whom they felt most strongly attached; there was also an extensive inquiry about the respondent's medical and health history. A section on family structure was concerned with the parents' age, education, occupation, and marital status. There were, in addition, items referring to the number and age of the respondent's siblings and also items regarding the respondent's own marital status, his children, and his spouse's age and education. The subject's responses were analyzed, and then reduced to different categories which were correlated with the various Krout subtests. Out of some 1,140 possible associations, there were only 10 which were significant at the 1 per cent level, 3 which were significant at the 2 per cent level, and 11 at the 5 per cent level. These 24 associations are only 2 per cent of the total possible number.

Because of the small number of significant associations, we are not presenting a table. There seems to be no *a priori* or theoretical reason for the associations between the personal data and KPPS variables which do occur. On the other hand, relationships for which associations might logically have been expected fail to emerge.

D. Discussion

In general it would appear that the normative material developed by the Krouts is inapplicable to the Oregon sample. At least half of the subtests in each group are significantly different. At face value it would seem that a comparison of our sample with general psychology students at the University of Illinois would be most appropriate, but we believe that the Oregon students are more like the Krout unselected sample. The Krouts report that their two samples are substantially equivalent. However, our re-analysis of their data (Nidorf, 1956) yields a somewhat different conclusion with respect, at least, to heterogeneity of variance, since a majority of the subscales differ significantly in these variances. In addition, the two Krout female groups differ significantly on the means for Subtest V and X; and the males' means differ on Subtests II and IX. It would appear then that, in addition to rather serious internal difficulties in the normative materials which the Krouts themselves present, these norms are probably not applicable to other college samples. Consequently, interpretation of subtest scores at the present time is a dubious matter, at best.

One of the most distinctive claims of the Krouts with respect to the PPS is that, as psychoanalytic theory would predict, there is no differentiation between the sexes on the first six subtests. With the Oregon sample three of the six pre-Oedipal scales have significantly different means: Oral Incorporative (II), Anal Expulsive (IV), and Sadistic (V). In our re-analysis of the Krout unselected sample we did find significant pre-Oedipal subtest differences on four of the six scales (I, IV, V, and VI). In general then, with regard to subtest scores for the two sexes, the KPPS does not yield the results which the psychoanalytic literature suggests should be expected.

In attempting to validate the KPPS, the Krouts utilized a technique which they called "validation by negation." The object is to show that the subtests measure independent modes of behavior. This is said to be the case if the intercorrelations among the 10 subtests are approximately of zero order. In reporting the first edition of the KPPS, the Krouts indicate that there are only seven coefficients which were over .35 while the mode was in the 20's. This finding suggests a considerable degree of independence among

subtests. However, the Oregon sample is clearly different, since more than half of the male associations were significant and substantial, though, to be sure, this was true for only 16 per cent of the female correlations. So, at least as far as the Oregon males are concerned, there is no evidence that the KPPS subtests are independent of one another.

If one considers, however, the logic behind the attempt to validate an instrument like the KPPS by negation, there is a substantial basis for believing that there should not be independence among the subtests. If fixation, indeed, does occur at some one stage of psychosexual development, it should be expected to have some effect upon subsequent psychosexual development. It is, of course, an empirical question as to exactly what the nature of this relationship should be; however, the differential behavior on one subtest should not be expected to be completely independent of performance on other subtests (Fenichel, 1945).

This interdependence would be especially true with regard to scores on the emotional maturity scale, and perhaps the social maturity scale. For the females, there are no pre-Oedipal subtests which are significantly associated with either Subtest IX or X. For the males, however (using the interpretive standards of the Krouts), the Oral Incorporative (II), Anal Sadistic (V), and the Phallic Narcissistic (VI) scales are significantly associated with the Social Maturity scale (X). There are, in addition, a number of correlations which seem to be contradictory. For example, Subtest V, which would indicate easy-going and carefree males, would not be expected to have a positive association with Subtest VIII, which is suggestive of aggressive and determined individuals; the association, however, is positive. Males who withdraw under pressure (I) are inclined to seek close object relations (II). In the other direction, the outgoing male who finds security in action (I) is reserved and tends to cling to the past (II). The effeminoid male who is passive and receptive (VII) tends to have high leadership qualities (X). The submissive receptive female (VII) who characterizes our Western culture, tends to be sarcastic, irritable, and not well-liked (III). An easy-going female who compromises readily (IV) has an overcompensated attitude to prove equality with males. And, finally, a verbally punitive, sarcastic, irritable woman (III) tends to be carefree, easy-going, and able to tolerate frustration (IV).

It might be argued that the above traits are not contradictory at all, but are characteristic of a person at a given time under different environmental conditions. This, however, would not be in the spirit of character study which

treats character as a constant, habitual, and regnant quality of the person (Fenichel, 1945). It may be that the usual interpretative standard for scales of this sort are perhaps too general in their formulation, but certainly the following quotation from the author's description of the Pre-Natal scale (I) does not suggest any situational limitations: "Relatively free from undifferentiated anxiety and, hence, active, out-going and inclined to seek new experiences." In sum, the rationale underlying the notion that the subtests should be independent seems dubious and the use of the subscale scores for characterizing particular individuals leads to the positing of contradictory traits for members, at least of the Oregon samples.

In the introduction to this paper it was suggested that the development of an objective instrument for measuring level of psychosexual development would be exceedingly valuable. An analysis of the KPPS items makes it very clear how difficult the task would be. As Miles (1954) has pointed out, the inferring of psychosexual characteristics from response patterns is very difficult. The major difficulty lies in a peculiar polarity. On the one hand, a response to a particular item may indicate a continuation of pre-genital impulses, a reaction-formation to such impulses, or a sub-limitation of these impulses. But, since the relationship of reaction-formation, sublimation, or continuation of pre-genital impulses to the character structure of an individual are markedly different, it is not at all clear that any given or collection of response patterns, without information concerning the psychological processes which generate them, casts very much light upon the psychosexual development of the individual. Since, unfortunately, the purpose of instruments of this sort is to provide precisely such information concerning personality development, it would seem that they must fail.

For example, consider Subtest IV, the Anal Expulsive scale. Item 1 is: "leaving things where they are." The Krouts suggest that the response to this item indicates the extent to which there is a carefree attitude in handling "things." They equate this with the "enjoyment of the process of rejecting fecal products." A "like" response to this item is supposed to refer to fixation at the anal expulsive level. However, it might also indicate the oral character's "disinclination to care for himself" or it might be a reaction-formation to anal retentive impulses, that is to say, the opposite of orderliness. As for the person who answers "dislike" to the item, he is said to lack early anal indulgence. But again, this may not be the case, for dislike could refer to the sublimated orderliness of the anal retentive stage. In any case, the item is by no means clearcut and affords a number of interpretations.

It is evident that the same type of argument may be developed for each and every one of the items in each of the scales. To that extent, it seems most unlikely that in the absence of any additional information concerning the individual's personality organization or psychosexual history that items of this sort can really bring very much to bear upon our understanding of personality development within the framework of psychoanalytic theory. On the other hand, this is not to mean that one could not, by a detailed empirical study of the sort which is conventional for questionnaire material, refine the subscales and determine a whole range of variables to which differential response patterns on the KPPS are related. Whether the phenomena involved would turn out to be those psychosexual conditions and events upon which analytic theory rests, however, is another matter.

E. Summary

The present study sought to assess the Krout Personal Preference Scale in terms of its norms, rationale, and validity. Subjects were psychology students—181 males and 140 females. For the most part, results were negative. The published norms were shown to be representative of too restricted a population to allow their general usage. The rationale and validity of the KPPS were not supported for the following reasons: The pre-Oedipal subtests which were supposed to be similar for both sexes showed significant differences in the Oregon sample; some of the subtest correlations required the positing of contradictory traits within the same individual; there were no more personal history variables significantly associated with the subtests than would be expected by chance; and the subtest items were shown to be logically ambiguous. It was concluded that the KPPS would not adequately measure psychosexual fixation without extensive analytical and empirical clarification.

References

1. Fenichel, O. The psychoanalytic theory of the neurosis. New York: Norton, 1945.
2. Krout, M. H., & Krout, J. A Guide to the Personal Preference Scale. Chicago: Chicago Psychol. Institute, 1953.
3. Krout, M. H., & Tabin, J. K. Measuring personality in developmental terms: The personal preference scale. *Genet. Psychol. Monog.*, 1954, **50**, 289-335.
4. Miles, D. W. The import for clinical psychology of the use of tests derived from theories about infantile sexuality and adult character. *Genet. Psychol. Monog.*, 1954, **50**, 227-288.
5. Munroe, R. L. Schools of Psychoanalytic Thought. New York: Dryden Press, 1955.

6. NIDORF, L. A study of the Krout Personal Preference Scale. (Unpublished M.A. Thesis, University of Oregon, 1956.)
7. STAGNER, R., LAWSON, E. D., & MOFFITT, J. W. The Krout Personal Preference Scale: A factor analytic study. *J. Clin. Psychol.*, 1955, **11**, 103-113.
8. STAGNER, R., & MOFFITT, J. W. A statistical study of Freud's theory of personality types. *J. Clin. Psychol.*, 1956, **12**, 72-74.

Department of Psychology
University of Oregon
Eugene, Oregon

The Journal of Genetic Psychology, 1961, 98, 29-35.

RESPONSES OF TWO-YEAR-OLD CHILDREN TO CONTROLLED STRESS SITUATIONS*

Child Development Research Laboratories, Iowa State University

D. Bruce Gardner, Damaris Pease, and Glenn R. Hawkes[1]

A. Introduction

In 1956 the staff of the Child Development Research Laboratories at Iowa State University initiated a research project designed to determine the effects, if any, of the experiences of infants subjected to unusual and discontinuous mothering experiences (3). The issue of whether such unusual mothering conditions constitutes maternal deprivation has been raised at various times by a number of writers, and the literature need not be reviewed here. In our research we have made the assumption that if there are any deleterious effects from such experiences there should be measurable differences in the development and/or behavior of children exposed to such non-continuous mothering, as compared with children not so treated, under appropriately controlled research conditions.

Through the excellent cooperation of the Iowa Children's Home Society, and with the moral and financial support of the Elizabeth McCormick Memorial Fund, 127 infants were enrolled in the project. About one-third, 37, of these were, during early infancy, residents in a home management house on the College campus, and were nurtured during the first four months of life by as many as 18 different mother figures before they were subsequently adopted. Another third, 44, of the infants resided for an equivalent period of time in foster homes, on a boarding arrangement, prior to being adopted. The final third, 46, of the infants represented a control group, born into ordinary families, and these experienced no unusual mothering situations but remained with their natural parents.

By December of 1958, 63 of the subjects, apportioned about equally among the three groups, had reached the age of 24 months. By that time they had been examined on at least seven occasions by an examining team including a physician, two psychologists, a nurse, and a social worker. Thus considerable

* Received in the Editorial Office on May 7, 1959.

[1] Journal Paper No. J3676 of the Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa, Project No. 1299. Acknowledgement is due the Elizabeth McCormick Memorial Fund for partial financial support.

information of a medical, psychometric, anthropometric, and general developmental nature had been accumulated on each child. It had also been determined, as was reported in an earlier publication (2), that the three groups had not differed from each other appreciably in developmental status shortly after birth, and that for statistical purposes they could be thought of as members of the same population.

At the age of 24 months, in addition to the medical, psychological, anthropometric, and other data collected as had been done at each previous examination, two special tests were administered. These were situational tests designed to reveal the subjects' responses to controlled stress situations. The general null hypothesis being examined here is that discontinuous mothering, as previously described, has no measurable effects on the responses of children to stress situations. This can be broken down into several more functional working hypotheses: (*a*) children who lived in home management houses cannot be identified by their peculiar responses to stress situations; (*b*) children who lived with foster parents prior to adoption cannot be identified by peculiar responses to stress situations; (*c*) adopted children in general cannot be identified by peculiar responses to stress situations; and (*d*) responses to stress are not, at the age of 24 months, sex related.

B. The Stress Situations

The first of the situations involved presenting the subject with a small pegboard with five circular openings, and with five brightly colored wooden pegs which could easily be inserted in the openings. The pegs were about three-quarters inch in diameter and four inches in length, with one flat end and one round end on each. After the subject completed inserting the pegs in the openings the pegs were removed by the examiner. A second set of pegs, similar to the first but of a diameter slightly larger than the openings in the board, was then presented unobtrusively to the child. After a period not exceeding one minute the set of oversized pegs was removed by the examiner and the original set of properly fitting pegs was restored. During this time the child was seated on his mother's lap, next to an examination table. In addition to the subject, the subject's mother, and the examiner, there was also present in the room another member of the examining team who recorded the actions of the subject throughout the sequence.

This first stress situation we have called the "Peg-Frustration Test." It was followed immediately, for each subject, by the second situation which we have labeled the "Stranger-Relationship Test."

When the pegboard materials were removed from the child and put away, the examiners left the room, instructing the mother to follow them and leave the child alone in the room for a minute. The examiners stationed themselves at an observation window and made records of the subject's initial reaction to being left alone by his mother. This first phase of the situation lasted only 15 seconds and was terminated by the entrance of a woman, a member of the research team who had not until this time had any direct contact with the child. She seated herself and maintained a passive attitude in relation to the subject. The stranger was instructed not to initiate activities or communication, but to respond appropriately to any overtures on the child's part. At the conclusion of a one-minute period the stranger stood up, offered her hand to the child, and said, "Shall we go find Mommy?"

Both of the situations described here are brief, elemental in nature, and uncomplicated in administration. Yet they contain elements of a wide range of situations encountered in "real life" which involve frustration and attendant stress.

It might be pointed out at this juncture that we have not attempted to describe any patterns of ideal behavior in response to these situations. Nor would we care to say what constitutes inferior behavior on the part of a two-year-old child. Perhaps at least as many arguments could be raised in favor of the child who throws the over-sized pegs on the floor, and who screams loudly as his mother departs and the stranger enters, as for the child who displays a marked reserve under the pressure of these situations. Regardless of this, such questions remain outside the scope of the immediate analysis. For purposes of this report we have concerned ourselves not with the ultimate significance of any particular pattern of response, but with the question of whether the three groups of children differ significantly with respect to their typical reactions and, incidentally, whether the reactions of boys are different from those of girls.

C. Analysis of Records

The records of the children in the peg-frustration situation were presented to three of the professional staff members of the Child Development Research Laboratories. These judges made ratings of all the 63 subjects, the records being presented to them in an unpredictable random order with no identifying information. The peg-frustration protocols were rated first in the dimension of *persistence*. This was defined as the degree of perseverance of the child in making use of the pegs and pegboard when faced with frustration of pegs

which would not fit the board. The second rating on the same protocols, *constructiveness of pegboard behavior,* was defined as the degree of creativity, resourcefulness, and flexibility in perceiving new and constructive uses of the materials.

The midpoint of each of the rating scales was assigned a value of three, and deviations around that midpoint ranged from one through five. The separate judgments of the three raters were correlated with each other and the results are shown in Table 1.

TABLE 1
CORRELATIONS AMONG JUDGES' RATINGS

	2 Ratings			3 Ratings		
Judge	a	b	c	a	b	c
1	.75	.79	.87	.60	.71	.84
2				.62	.63	.89

In that table Ratings *a* and *b* refer, respectively, to the *persistence* dimension and the *constructiveness* dimension in the peg situation. Rating *c* pertains to the records made of the subjects' responses in the stranger situation. This rating was labeled, *"Constructiveness, SRT,"* and was defined as the quality of each child's responses to being left alone by his mother and to the presence of an adult whom he did not know. Constructive responses, in general, were defined as resourceful uses of (*a*) the objects in the room and/or (*b*) the adult stanger. Unconstructive responses were characterized by rigid non-adaptive behavior, or by psychological withdrawal from the situation.

A fourth judgment was made in a somewhat different manner, and could not be scaled in the manner of Ratings *a, b,* and *c*. Rating *d* consisted of assigning each subject to one of three mutually exclusive categories, on the basis of the records of their responses in the stranger relationship situation. The categories represented basic directions of response to frustration: (*a*) outward behavior directed toward the objective environment, (*b*) outward behavior directed toward the stranger, and (*c*) inwardly directed behavior, such as turning to oneself for comfort, as in standing in the corner sucking one's thumb.

Again, there is no attempt here to define one of these three categories of response as being more appropriate for a two-year-old child than another. Our question is merely whether the blind judgments of professional psychol-

ogists in assigning children to one or another of these categories on the basis of predominant behavior pattern while in the situation is in any way associated with the group or with the sex of which he is a member.

Statistical analysis of Ratings *a*, *b*, and *c* were identical in kind, and involved in the averaging of the ratings of the three judges to obtain one score for each subject for each dimension. The mean scores for the three groups and the two sexes are shown in Table 2.

TABLE 2
MEAN SCORES BY GROUP AND BY SEX

Group	N	Rating a	b	c
A	23	3.13	2.12	2.96
B	18	3.65	2.54	3.09
C	22	3.45	2.74	2.76
Males	30	3.54	2.56	2.94
Females	33	3.25	2.36	2.92
Total	63	3.39	2.45	2.93

The next step involved an analysis of variance for each of the three dimensions. For analysis of variance purposes, a two-way classification of each child's score was made. That is, each child's score was located in a cell representing his group and his sex. From the resulting six-celled table, *F* ratios were computed to determine whether there was a significant variation among the three groups and between the two sexes, and whether there were significant interaction effects of groups with sexes.

D. RESULTS

The *F* ratios were very small, as is shown in Table 3. In that table a blank space indicates that the ratio would have been less than 1.0 had it been computed. For the number of degrees of freedom in this group of 63 children, an *F* ratio would have to be at least 3.0 to be significant at the 5 per cent level. Thus the minor differences found among groups as well as between sexes are not significant.

TABLE 3
SIGNIFICANCE OF DIFFERENCES: F RATIOS

	Ratings a	b	c
Groups	1.07	2.04	—
Sexes	—	—	—
G × S	1.73	1.85	2.37

An interesting relationship was noted between Ratings *a*, *b*, and *c*. The intercorrelations among these three dimensions are shown in Table 4. The high positive correlation between Ratings *a* and *b* may be partially explained on the basis of some general halo effect in ratings on the peg frustration protocols. Furthermore, the quality we have defined as *persistence* may operate as a limiting variable within which the quality, *constructiveness,* may be allowed to function, thus artificially increasing the size of the correlation coefficient.

TABLE 4
INTERCORRELATIONS AMONG RATINGS

Rating	b	c
a	.74	—.32
b		—.37

The negative relationships between these two and Rating *c* is less clear, however, and it would be interesting to speculate on the tendency of children who are persistent and constructive in an objective situation to be relatively unconstructive in a difficult social situation. This, however, would involve us immediately in the question of the true meaning and validity of the scales. Since we have applied such names as "constructiveness" in a rather arbitrary fashion, and since we are not prepared to say that constructiveness in the peg situation has the same psychological meaning as constructiveness in the stranger situation, it is probably safer not to speculate a great deal on the interpretation of these negative correlation coefficients.

It may be of interest to note in passing that these three ratings, which do correlate among themselves and which are based on a significant degree of inter-judge agreement, do not correlate with other data available on the subjects. These included Cattell Infant Intelligence Scale scores, California Test of Motor Development scores, developmental quotients based on the Gesell Developmental Schedules, and a number of measurements of body size. None of these variables correlated significantly with any of the three ratings for the situational tests.

Rating *d* had to be treated differently from the other three, inasmuch as it involved the assignment of each child to one of three mutually exclusive categories in their stranger relationship behavior. A chi square analysis was made to determine whether this categorization of children by major direction of responses was in any way associated with the groups to which they belonged. We wanted to know, in other words, if home management house children

tended to respond in the direction of the stranger more or less frequently than did children in the other two groups.

The chi square analysis revealed that there was no significant relationship between group and direction of response. Similarly, when the same technique was applied to determine whether there was any interaction effect of sex with direction of response, the chi square was not significant.

E. Conclusions

In general, it was concluded that the null hypothesis could not be rejected. The home management house children did not respond differently in these stress situations than did foster home children. Adopted children in general did not respond differently than did non-adopted children. Boys and girls did not differ in their responses in any of the dimensions.

By way of discussion, it might be noted that the absence of any statistically significant F ratios or chi squares cannot be accounted for on the basis of there simply being no variation in the children's performances. Actually these two simple situations provided a relatively rich supply of descriptive records in which were found wide ranges of performance in constructiveness, persistence, and direction of response. The differences, however, were individual, not group or sex differences.

Whether the individual differences noted on the single occasion of each child's two-year-old examination are in any way predictive of adjustment in later childhood remains to be determined by follow-up studies of these same children. In any event it seems safe to say that their performance at 24 months in these two situations was not colored by any detrimental effects which the children might have experienced while living in a home management house, or in a foster home, or as a result of being adopted children, and that it was not a function of their sex.

References

1. Gardner, D. B., & Pease, D. The use of situational tests with preschool children. *J. Nurs. Educ.*, 1958, **14**, 18-20.
2. Gardner, D. B., & Swiger, M. K. Developmental status of two groups of infants released for adoption. *Child Devel.*, 1958, **29**, 521-530.
3. Pease, D., & Gardner, D. B. Research on the effects of non-continuous mothering. *Child Devel.*, 1958, **29**, 141-148.

Department of Child Development
Iowa State University
Ames, Iowa

The Journal of Genetic Psychology, 1961, 98, 37-46.

THE DEVELOPMENT OF QUANTITATIVE THINKING: A SYSTEMATIC REPLICATION OF PIAGET'S STUDIES*

Department of Psychology, Wheaton College, Norton, Massachusetts

DAVID ELKIND[1]

A. PROBLEM

One of the continuing needs in psychology is for the replication and refinement of significant experiments. This is especially true for the experiments of the Swiss psychologist, Jean Piaget. For over 30 years Piaget has been studying the development of children's thinking but many of his studies (Piaget, 1928; 1929; 1930) have been devoid of statistical methods and systematic design. The present replication study takes one of Piaget's later (1952) investigations as its starting point. It differs from other replications of Piaget's work (Dennis, 1940; Deutsche, 1937; Oakes, 1947) in being the first to systematically repeat Piaget's experiments on children's quantitative thinking.

Piaget assumes that the child's quantitative thinking develops and that the child's success in comparing quantity earmarks this development. By studying the child's responses to quantity comparisons of increasing difficulty Piaget sought to trace the developmental changes in the form and content of the child's quantitative thought.

In his work Piaget distinguishes three types of perceived quantity by which things can be compared without actual measurement. The simplest type of perceived quantity he speaks of as *gross*. Gross quantities are single perceived relations between objects (longer than, larger than) which are not coordinated with each other. A more complex type of quantity Piaget calls *intensive*. Intensive quantities are perceived quantity relations taken two by two (longer and wider, taller and thicker). The most complex type of perceived quantity Piaget calls *extensive*. Extensive quantities are unit relations between objects (X is half of Y, X is twice Y, etc.). Extensive quantities are logical constructs which must be attained by abstraction or

* Received in the Editorial Office on May 8, 1959.
1 This study was carried out while the author was Research Assistant to David Rapaport at the Austen Riggs Center, and was supported by the Ford Foundation's Grant in Aid of Research.

reasoning but Piaget assumes that once attained, the subject perceives them directly as perceptually given properties of the object.

To test for success in comparing quantity Piaget had subjects of various ages compare two amounts of material several times. The two amounts were successively arranged so that sometimes a comparison of gross, sometimes a comparison of intensive, and sometimes a comparison of extensive quantity was the minimum requirement for a successful result. Experimenting with a variety of materials, including liquids, sticks, and beads, Piaget found three, age related, hierarchically ordered stages of success in comparing quantity.

Children at the first stage (usually age 4) succeeded only when a comparison of gross quantity was the minimum requirement for success. At the second stage (usually age 5) children succeeded when a comparison of gross or intensive quantity was the minimum requirement for success. Third stage children (usually age 6-7) succeeded when a comparison of gross, intensive, or extensive quantity was the minimum requirement for a successful result. Piaget reports his findings and interpretations with the aid of a great many illustrative experimental examples but without the aid of statistics.

In the present study the following hypotheses, derived from Piaget's findings, were tested: (*a*) that Age Groups (4, 5, 6-7) differ significantly in their success in comparing quantity; (*b*) that the Type of Quantity required (gross, intensive, or extensive) by the test significantly affects successful comparison; (*c*) that the Type of Material (sticks, liquids, or beads) significantly affects successful comparison; (*d*) that Age and Type of Quantity jointly affect successful comparison (the statistical test of Piaget's stages); (*e*) that Type of Quantity and Type of Material jointly affect successful comparison; (*f*) there is a positive correlation between performance on the three Types of Material; (*g*) there is a positive correlation between success in comparing quantity and performance on the W.I.S.C.

B. Method

1. *Subjects*

Eighty school and pre-school children living in Pittsfield, Mass., were tested. They were divided into three age groups and the number in each group was; Age four, 18, Age five, 40; Ages six and seven, 22. For each group the mean age and standard deviation were: Age four, 54.0 and 2.6 mos.; Age five, 64.9 and 2.7 mos.; Ages six and seven, 80.9 and 6.2 mos.

2. *Procedure*

All *S*s were tested on three types of material (sticks, liquids, beads) for three types of quantity. Each *S* compared two amounts of each material six times. The amounts were successively arranged[2] so that twice the minimum requirement for success was a comparison of gross quantity, twice the minimum requirement for success was a comparison of intensive quantity, and twice the minimum requirement for success was a comparison of extensive quantity. *E*'s directions were always phrased with general quantity terms like "number, amount, same," which could be taken either in the gross, intensive, or extensive sense. Because of this ambiguity in language, it was assumed that the verbal directions did not provide clues to the type of quantity that had to be compared.

The school age *S*s were tested on one material at a time at weekly intervals. The pre-school *S*s were tested at hourly intervals in one morning. All *S*s took the tests in the same order; sticks, liquids, beads. The tests were structured as the games described below.

a. Sticks. Twenty-four wooden sticks, ¼″ square by 1¼″, were on the table. *E* "Let's pretend these sticks are candies. Your mother gives me this many candies." *E* takes six and puts them in a row at 1″ intervals. *E* "You take just as many candies as I have, take the same number of candies as me." (Comparison of intensive quantity.)

After *S* took his "candies" *E* shortened his row and asked *S* to do the same. If *S* had taken more or less than six, shortening the rows made this immediately apparent and *E* asked him to "Make them the same." When the two rows were closed and of the same length, *E* asked "Do we both have the same number of candies?" (Comparison of gross quantity.)

E then spread his "candies" apart again but left *S*'s together so that *E*'s row was much longer but still equal in number of *S*'s row. *E* "Do we both have the same number of candies?" (Comparison of extensive quantity.)

The entire test was then repeated. The second time *E* arranged the sticks lengthwise and asked *S* to pretend the sticks were railroad cars and that they were making trains. The questions were phrased accordingly e.g., "Do we both have the same number of cars?" etc.

b. Liquids. Two 16 oz. and two 8 oz. drinking glasses were on the table beside a tall narrow glass and a pitcher of orange colored water. *E* "Let's

---

[2] Piaget's qualitative behavior analyses (Piaget, 1952) revealed what type of quantity comparison a particular arrangement required for a correct solution.

pretend we are at a party and this colored water is orangeade. Your mother pours this much for you," *E* fills one 16 oz. glass ¾ full, "and this much for me," *E* fills the outer 16 oz. glass ¾ full. *E* "Do we both have the same amount of orangeade to drink, do I have just as much as you?" (Comparison of gross quantity.)

Then, while *S* watched, *E* poured the "orangeade" from *E*'s glass into the two 8 oz. glasses so that the levels in the two were equal but lower than the level in the 16 oz. glass. *E* "Now my drink is in these two glasses and yours is in this glass, do I have the same amount of drink as you?" (Comparison of extensive quantity.)

Next *E* poured all the orangeade back into the pitcher and took one 16 oz. glass and the narrow glass leaving the other containers aside. *E* filled the wide and narrow glasses to the same level and said "My drink is in here," pointing to the narrow glass, "and your drink is in there," pointing to the 16 oz. glass. *E* "Do we both have the same amount to drink, do I have as much to drink as you?" (Intensive comparison.)

E then repeated the entire procedure but the second time used the 8 oz. glass in the comparison with the narrow glass.

c. Beads. The procedures and containers used in this test were the same as those in the test with liquids. However, large wooden beads instead of colored water were used as the material. The diameter of the beads was such that only one could fit into the narrow glass at a time making a single column like an upturned necklace. The questions were phrased "Do we have the same amount of beads, do we both have the same number of beads?" etc.

d. Scoring. Each successful comparison was given a score of 1 and all failures were scored zero. For each *S* there was a total possible score of 18; for each type of material and for each type of quantity there was a total possible score of six.

e. Statistical analysis. To test the major hypotheses of this study—about the separate and combined effects of Age, Type of Quantity, and Type of Material on children's success in comparing quantity—a $3 \times 3 \times 3$ analysis of variance design was used (Lindquist, 1953, pp. 392-397). For two variables, Type of Quantity and Type of Material, between subject differences were controlled by testing all *S*s on all types of quantity and all types of material.

C. Results[3]

1. *Age*

Piaget found that children's success in comparing quantity increased with age. In the present study the over-all F for the effects of Age was 56.88 and was significant beyond the .01 level. Table 1 gives the Age Group means, standard deviations, and t ratios. It shows that success in comparing quantities increased significantly with age in agreement with Piaget's finding.

TABLE 1
Comparison Score Means, Standard Deviations and t Ratios for Three Age Groups

Age group	N	Mean Score	SD	t
4	18	7.78	1.51	4.15*
5	40	9.98	2.46	7.87*
6-7	22	15.41	2.67	11.39*
4	—	—	—	

* Significant beyond the .01 level.

2. *Type of Quantity*

Piaget's illustrative examples indicated that other things being equal, the type of quantity required for a correct comparison affected children's success and failure. The same held true for the *S*s of the present study. For the Type of Quantity means the over-all F was 480.90 and was significant beyond the .01 level. Statistics for the individual Type of Quantity means are given in Table 2. Gross quantities were the easiest to compare, intensive were

TABLE 2
Comparison Score Means, Standard Deviations and t Ratios for Three Types of Quantity
(N = 80)

Type of quantity	Mean score	SD	t
Gross	5.98	0.71	3.80*
Intensive	3.51	1.83	5.12*
Extensive	1.47	2.47	5.82*
Gross	—	—	

* Significant beyond the .01 level.

[3] There was no reason to expect, from Piaget's findings, significant Age-Type of Material or Age-Type of Quantity-Type of Material interactions, and the F's for these interactions were NS.

intermediate, and extensive quantities were the hardest to compare. This result agreed with what Piaget reported.

3. *Type of Material*

In regard to the many types of material he used, Piaget concluded that success in comparing a given type of quantity of a certain type of material did not necessarily generalize to all materials. In the present study the F for Type of Material was 48.00 and was significant beyond the .01 level. Table 3, which gives the statistics for individual means, shows that liquids were the most difficult material to compare and produced the significant F. Piaget does not report this result with liquids as a specific finding but suggests

TABLE 3
COMPARISON SCORE MEANS, STANDARD DEVIATIONS AND t RATIOS FOR THREE TYPES OF MATERIAL
($N = 80$)

Type of material	Mean score	SD	t
Stick	3.84	1.40	
Liquids	2.99	1.26	3.26*
Beads	4.15	1.50	4.46*
Sticks	—	—	1.19

* Significant beyond the .01 level.

comparison of a quantity of liquid may be more difficult because liquids are not broken up into perceivable units as are the sticks and beads. The present results support this assumption.

4. *Interaction of Age with Type of Quantity*

The stages Piaget reported suggested that success in comparing quantity depended jointly on age and the type of quantity comparison required by the test. In the study reported here, this joint effect was tested by the Interaction of Age with Type of Quantity. The F for this interaction was 35.57 and was significant beyond the .01 level. Table 4 shows that while the order of difficulty for types of quantity was the same at each age, the difference in difficulty decreased with age, and only the means at the four and five year levels were significantly different.

As indicated in Table 4, the majority of the four year group succeeded only with gross quantities, the majority of the five year group succeeded only with

gross and intensive quantities, while most of the six and seven year group succeeded with all types of quantity. This agreed with Piaget's findings of age related, hierarchically ordered stages in the development of success in comparing quantity.

TABLE 4
COMPARISON SCORE MEANS AND F RATIOS FOR THREE TYPES OF QUANTITY FOR THREE AGE GROUPS

N	Age group	Quantity compared: Gross	Intensive	Extensive	F
18	4	5.88	1.77	0.11	221.10*
40	5	6.0	3.20	0.75	220.76*
22	6-7	6.0	5.49	3.95	4.78

* Significant beyond the .01 level.

5. *Interaction of Type of Quantity with Type of Material*

The interaction F for Type of Quantity and Type of Material was 15.17 and was significant beyond the .01 level. Table 5 shows that the order of difficulty for types of quantity was the same for all materials. Table 5 also shows that the order of difficulty for types of material was the same for intensive and extensive quantities. However, the differences between the means of Type of Material were greater for intensive quantities than they were for extensive quantities. The intensive quantity of liquids, perceived in a narrow glass vs. perceived in wide glass, was unusually difficult for the *S*s of this study to compare.

TABLE 5
COMPARISON SCORE MEANS AND F RATIOS FOR THREE TYPES OF QUANTITY FOR THREE TYPES OF MATERIAL
(N = 80)

Material used in comparison	Quantity compared: Gross	Intensive	Extensive	F
Sticks	1.99	1.38	.48	96.46*
Liquids	2.0	.66	.33	179.37*
Beads	1.99	1.48	.69	65.99*
F	.01	78.20*	13.20*	

* Significant beyond the .01 level.

6. *Correlations for Three Types of Material*

Implicit in Piaget's work on quantity was the assumption that the comparisons with different materials tapped the same conceptualizing ability. Table 6 gives the inter-correlations for the three materials used in the present study. The correlations were all high and significant. This result

supported Piaget's assumption that a common conceptualizing ability underlies children's success in comparing quantity with different materials.

TABLE 6
COMPARISON SCORE CORRELATIONS FOR THREE TYPES OF MATERIAL
(N = 80)

Material	Liquids	Beads
Sticks	.90*	.64*
Liquids		.76*

* Significant beyond the .01 level.

7. *Comparison and W.I.S.C. Score Correlations*

The Wechsler Intelligence Scale for Children was administered to the 62 school age children who took part in the study.[4] For each age group (5 and 6-7) Z scores were computed for the quantity scores, and these were used in the correlations with the IQs given in Table 7. In the sub-test correlations obtained comparison scores were used. The correlations were generally positive, sometimes significant, and usually low. High correlations occurred with Picture Arrangement, Arithmetic and Coding which, like the comparison of quantity, involve conceptual organizing.

TABLE 7
QUANTITY COMPARISON AND W.I.S.C. SCORE CORRELATIONS
(N = 62)

Sub test correlations[a]			
Verbal		Performance	
Vocabulary	.31	Picture Completion	.13
Information	.47*	Picture Arrangement	.55*
Similarities	.29	Block Design	.26
Comprehension	.19	Object Assembly	.38*
Arithmetic	.35*	Coding	.42*
Digit Span	.20		

IQ Correlations[b]	
Verbal	.47*
Performance	.29
Full Scale	.43*

[a] With obtained Comparison Scores.
[b] With transformed Comparison Scores.
* Significant beyond the .01 level.

D. DISCUSSION

The results of the present study were in agreement with Piaget's finding three, age-related, hierarchically ordered stages of success in comparing quan-

[4] The author is indebted to Mrs. Jules Miller who administered the IQ tests.

tity. Piaget assumes that success in comparing quantity earmarks developmental changes in both the form and the content of children's quantitative thinking.

With regard to content Piaget's view is that stages of success in comparing quantity earmark steps in the development of an abstract quantity concept. Children at the first stage have only a general impression of quantity which Piaget calls a *global* conception. When forced to break down this impression and compare objects, first stage children make use of single perceived relations or gross quantity. Second stage children have a differentiated, relatively precise impression of quantity which Piaget speaks of as an *intuitive* conception. In comparing objects, second stage children deal with perceived relations two by two or with intensive quantity. At the third stage children have the impression of quantity as a logical whole which Piaget speaks of as an *abstract* conception. In comparing objects, third stage children do so in unit terms or by extensive quantity.

With regard to the form of thought Piaget assumes that stages of success in comparing quantity earmarks the development of internalized actions which he calls *mental operations*. It is the development of *logical multiplication* (the operation of coordinating two judgments of perceived relations) which makes possible the step from gross to intensive quantification and it is logical multiplication plus the development of *equation of differences* (the operation of coordinating judgments of the magnitude of differences between objects) which makes possible the step from intensive to extensive quantification.

The present study did not attempt to test Piaget's conception of the development of quantitative thinking in the child. It did seek to further substantiate some of those observations which Piaget reports and builds his conception upon.

E. Summary

Eighty school and pre-school children were divided into three Age Groups (4, 5, 6-7) and tested on three Types of Material for three Types of Quantity in a systematic replication of Piaget's investigation of the development of quantitative thinking. Analysis of variance showed that success in comparing quantities varied significantly with Age, Type of Quantity, Type of Material, and two of the interactions. Correlations for Types of Material were positive, high, and significant. Correlations of comparison scores and W.I.S.C. scores were positive, generally low, and sometimes significant.

The results were in close agreement with Piaget's finding that success in

comparing quantity developed in three, age related, hierarchically ordered, stages. Piaget's conception of these stages as representing steps in the development of the form and content of children's quantitative thinking was briefly presented.

References

1. Dennis, W. Piaget's questions applied to Zuni and Navaho children. *Psychol. Bull.*, 1940, **37**, 520.
2. Deutsch, J. M. The development of children's concepts of causal relations. *Univ. Minn. Inst. Child Welf. Monog.*, 1937.
3. Lindquist, E. F. Design and Analysis of Experiments in Psychology and Education. Cambridge, Mass.: Riverside Press, 1953.
4. Oakes, M. E. Children's explanations of natural phenomena. *Teach. Coll. Contr. Educ.*, 1947.
5. Piaget, J. Judgment and Reasoning in the Child. London: Routledge & Kegan Paul, 1928.
6. ————. The Child's Conception of the World. London: Routledge & Kegan Paul, 1929.
7. ————. The Child's Conception of Physical Causality. London: Routledge & Kegan Paul, 1930.
8. ————. The Child's Conception of Number. London: Routledge & Kegan Paul, 1952 (first French printing, 1941).

Department of Psychology
Wheaton College
Norton, Massachusetts

The Journal of Genetic Psychology, 1961, 98, 47-48.

FLUENCY ABILITIES IN PRESCHOOL CHILDREN*

School of Education, University of Wisconsin

CARL BEREITER[1]

The only published study of fluency abilities in young children is that by Gewirtz (2) in which correlations were computed for 10 measures of verbal fluency given to 38 children between the ages of 5-0 and 6-7. In order to make comparison possible between these data and findings with regard to fluency in older *Ss*, the present writer did a centroid factor analysis of eight of the fluency variables along with the Stanford-Binet vocabulary subtest, using the intercorrelations reported by Gewirtz. Three factors were extracted and rotated to oblique structure by the direct method (4). The tests used and the oblique factor pattern obtained are reported in Table 1.

TABLE 1
OBLIQUE FACTOR MATRIX

Tests	I	II	III
1. Rhymes (Give words rhyming with stimulus syllable)	.66	.47	.01
2. Alliterations (Give words beginning with given sound)	.19	.57	.00
3. In the . . . (Give completions to phrase)	.14	.56	.14
4. Child Names (Name as many children as possible)	.48	.17	.24
5. Adult Names	.29	.00	.80
6. Thing Names	.00	.50	.54
7. Disarranged Sentences (Unscramble short sentences)	.47	.77	—.02
8. Types (Number of different words used in telling about *S*'s house)	.07	.00	.52
9. Stanford-Binet Vocabulary Subtest	.73	.00	.00

Considering the low reliability of the correlation coefficients, the factor structure is remarkably clear. Factor I is virtually uncorrelated with the other two factors ($r = -.02$ with Factor II, .01 with Factor III). It accounts for all the common factor variance of the Stanford-Binet vocabulary subtest, thus clearly marking it as a power factor of some sort rather than a fluency factor. Rhymes and Disarranged Sentences are also tests with relatively

* Received in the Editorial Office on May 14, 1959.

[1] The writer wishes to thank Prof. C. W. Harris for his helpful suggestions in carrying out this analysis.

strict requirements, so that it is not unlikely that for young children performance on these tests is more a function of general verbal ability than of ease and speed in responding. The loading of Child Names on Factor I is somewhat puzzling. If this factor is a kind of general maturity factor, then it might merely indicate that the more mature child knows more other children.

Factors II and III evidently account for the fluency components of the tests. They are somewhat negatively correlated ($r = -.24$). Tests loading Factor II seem to be the more purely verbal tests, involving word arrangements and word sounds, whereas the tests loading Factor III seem to be involved with ideas, with naming people and things. This is clearly true of Adult Names and Thing Names, and is probably true of Types, for in a young child the number of different words he uses in describing his house probably depends almost wholly on how many different things he can think of to say about it.

These factors are about what one could expect to get from an analysis of similar scope carried out on older *Ss*: a general verbal factor (with children of this age, perhaps better called a verbal maturity factor), a verbal fluency factor, and an ideational fluency factor. In studies using a larger number of fluency tests, the verbal fluency factor has been found to break down into several more specific fluency factors (1, 3, 5). Whether this would happen with young children or whether verbal fluency abilities are not differentiated at such an early age remains to be discovered by larger-scale studies. The present findings indicate that fairly well-defined fluency abilities can be measured in young children, thus lending encouragement to further factor analytic study of mental organization in the very young.

References

1. Carroll, J. B. A factor analysis of verbal abilities. *Psychometrika,* 1941, **6,** 279-306.
2. Gewirtz, J. L. Studies in word-fluency: I. Its relation to vocabulary and mental age in young children. *J. Genet. Psychol.,* 1948, **72,** 165-176.
3. Guilford, J. P., & Christensen, P. R. A factor-analytic study of verbal fluency. *Univer. Southern Calif., Rep. Psychol. Lab.,* No. 17, 1956.
4. Harris, C. W. Direct rotation to primary structure. *J. Educ. Psychol.,* 1948, **39,** 449-468.
5. Taylor, C. W. A factorial study of fluency in writing. *Psychometrika,* 1947, **12,** 234-262.

Mary Conover Mellon Foundation
Vassar College
Poughkeepsie, New York

The Journal of Genetic Psychology, 1961, 98, 49-54.

STRENGTH OF A SECONDARY REINFORCEMENT AS A FUNCTION OF THE QUALITY OF FOOD REWARD*

Department of Psychology, Purdue University

GEORGE W. LEWIS AND KENNETH M. MICHELS

A. PROBLEM

The following study was designed to test the hypothesis that the strength of secondary reinforcement varies as a function of the quality of primary food reward.

Hopkins (5) failed to find evidence of a differential transfer effect when a group of albino rats trained with plain food was compared with a group trained on saccharinized food. This study appears to be the only one in which the effect of reward quality on secondary reinforcement has been investigated.

The present study incorporated four procedures not present in Hopkin's design. First, rats were given primary reinforcement in both of two differential environments, receiving a highly preferred food in one, and a less highly preferred food in the other. Second, *S*s were given much more experience, in terms of time in the two reward-stimulus situations. Third, the two foods used as primary rewards are known to differ widely in preference for the hooded rat (4). Finally, the animals were tested in a transfer situation under thirst drive, with water reward present. This test procedure was based on studies by D'Amato (1) and Estes (2, 3) which indicate that secondary reinforcement can transfer across the hunger and thirst drives.

B. METHOD

1. *Subjects*

Thirty-five naive male hooded rats between 90 and 100 days old at the beginning of the experiment were used. *S*s were randomly assigned to three groups.

2. *Apparatus*

The training apparatus consisted of nine rectangular wood boxes, $8 \times 9\frac{1}{2} \times 8$ inches with a hinged hardware cloth top. Three of the boxes were painted flat white, three flat black, and three with one inch black and

* Received in the Editorial Office on May 15, 1959.

white vertical stripes, having equal areas of black and white. Small round food cups, 2 inches in diameter and ½ inch deep were used to hold the foods.

The foods which were used as primary reward were (*a*) mixture of bread, milk, and sugar and (*b*) wet laboratory mash.

The test trial apparatus consisted of a single unit wood Y maze with a hardware cloth top. The main alley was 30 inches long, 5 inches wide, and 5 inches high. The response alleys were 18 inches long, 4 inches wide, and 5 inches high. The starting box and goal boxes were 8½ × 10 × 8 inches. The starting box and main alley were painted a flat gray; one response alley and goal box were a flat black; and the other response alley and goal box were flat white. Guillotine doors were placed at the front of the starting box, the junction of each response alley and the main alley, and the entrance to each goal box.

Two of the food cups from the training trials were used to hold water reward.

The maze was illuminated by four 60-watt bulbs in photoflood reflectors.

The response alleys could be switched from one side of the main alley to the other.

3. *Procedure*

Two replications of the following procedure were run.

a. Training trials. After a one-week adaptation period to a 23½ hour deprivation schedule 16 days of training were given as follows: Three training groups *B*, *W*, and *C*, were designated on the basis of the color of the box in which they received the preferred food. Group *B* was fed the preferred food (bread, milk, and sugar) in a black box and the non-preferred food (wet mash) in a white box. Group *W* was fed the preferred food in a white box and the non-preferred food in a black box. Group *C* was fed both foods in a black and white striped box. Preferred food was given on Days 2, 4, 5, 7, 10, 12, 13, and 15; non-preferred food was given on Days 1, 3, 6, 8, 9, 11, 14, and 16.

During the training period 23½ hour food deprivation was used and unlimited water was available at all times.

b. Test trials. For two days following Day 16 of the training period, *S*s were placed on 20-hour water deprivation. Unlimited food was available at all times. In both replications each group of animals (*B*, *W*, and *C*) was subdivided into two sub-groups of three animals each (with the exception of one control sub-group in the first replication which contained only two animals).

Groups were then given four trials to water reward in the Y maze as follows: One of each sub-group was run with water at black, the other with water at white. *S*s were run one trial at a time in serial order. The correct alley, previously associated with preferred food with attached goal box, was switched from side to side according to a random schedule. A non-correction technique was used throughout the test trials.

A trial was run as follows: A food cup was filled with water, and placed in the correct goal box and an empty cup was placed in the incorrect goal box. *S* was removed from its home cage and placed in the starting box of the maze. After 10 seconds had elapsed, the door of the starting box was raised, and as soon as *S* left the starting box the door to the starting box was lowered. When *S* entered a response alley, the door to that alley was lowered to prevent the animal from retracing. As soon as the animal entered the goal box, the door to that box was lowered and *S* was allowed to remain in the goal box for 10 seconds. The animal was then removed from the goal box and placed in its home cage.

4. *Design*

A 1 × 2 analysis of variance was run on the data for the four test trials of each replication, using training-test sub-groups as one variable, and replications as the other. A series of *t* tests was then run on the following sub-group comparisons from each replication: Black to Black vs. Black to White, White to White vs. White to Black, and Control to Black vs. Control to White. The Mean Square within group from the ANOV was taken as the best estimate of the population standard deviation. It was felt that differences between Black sub-groups or between White sub-groups would reflect the effect of secondary inforcement, whereas differences between Control groups would reflect the effects of a phototropism.

C. Results

The results of the test trials show that differences between groups on both replications were all in the predicted direction. That is, the Black to Black groups made significantly more correct responses than did the Black to White; the White to White groups significantly more than the White to Black; and there were no significant differences between the control groups.

The over all analysis of variance indicated significant differences between groups but not between replications.

Test trial differences between the Black to Black and Black to White, and White to White and White to Black groups on both replications yielded

*t*s significant beyond the .05 level of significance. Differences between the control groups on both replications did not yield significant *t*s (Table 1).

In Replication 1, groups ranked as follows in terms of mean number of correct responses on the test trials: (*a*) Black to Black with 3.3 correct responses; (*b*) White to White, 3.0; (*c*) Control to Black, 2.5; (*d*) Control to White, 2.0; (*e*) Black to White and White to Black, 1.3. In Replication 2 the ranking was: (*a*) Black to Black and White to White, 3.3; (*b*) Control to Black and Control to White, 2.0; (*c*) White to Black, 1.3; and (*d*) Black to White, 0.67.

TABLE 1
SUMMARY TABLE OF *t* TESTS

Comparison	*t*	Probability
Replication 1		
Black to Black vs. Black to White	3.515	.02
White to White vs. White to Black	2.935	.02
Control to Black vs. Control to White	.879	Not significant
Replication 2		
Black to Black vs. Black to White	4.675	.02
White to White vs. White to Black	3.515	.02
Control to Black vs. Control to White	0	Not significant

D. DISCUSSION

The data obtained in both replications of the present experimental design support the general hypothesis that the strength of secondary reinforcement varies as a function of the quality of primary food reward. These results differ from those of Hopkins (5), who found that the degree of secondary reinforcement evidenced in the behavior of albino rats who had received saccharinized food did not differ from that evidenced in the behavior of those

which had received an equivalent amount of plain food. Several reasons for this discrepancy are possible. First, there may be a sufficient sensory differential between the albino rat and the hooded rat to enable the hooded animal to respond to more subtile environmental cues than the albino. Second, the *S*s in the present study were given much more experience in the reward stimulus situation than were those in Hopkin's study (one-half hour per day for 16 days, as against 20 seconds per day for 30 days; a difference of seven hours and 50 minutes). Third, the two rewards used in the present study differ significantly in quality and in preference, so that the possible effects of quality differential were perhaps maximized. Finally, the present design utilized primary reinforcement in both training environments with a different food quality associated with each. This design would seem to amplify any variations in secondary reinforcement due to differential quality of primary reward.

The data indicate that secondary reinforcement does transfer across primary drive states. This is in agreement with the studies by D'Amato (1) and Estes (2, 3) which indicate that secondary reinforcement is (or becomes) independent of a specific drive state.

Perhaps the strongest support of the hypothesis under test is the fact that during the test trials, *S*s of the Black to White and White to Black groups continued to run to the color which had been associated with the preferred food during training trials even though appropriate reward was present in the alternate arm of the maze.

In general, the results of this study appear to support the hypotheses that the strength of secondary reinforcement varies as a function of the quality of primary food reward, and that such secondary reward can transfer from the hunger to the thirst drive.

E. Summary

The present study was conducted to test the hypothesis that the strength of secondary reinforcement varies as a function of the quality of food reward.

The experiment was run in two replications. In each replication three groups of hooded rats were used as subjects. One group of animals received a highly preferred food (bread, milk and sugar) in a black feeding box and a less highly preferred food (wet mash) in a white box. The second group of rats received the preferred food in white and the less preferred food in black. The third group received both foods in a black and white striped box. *S*s were maintained on 23½ hour food deprivation and received eight feedings in each reward-stimulus situation.

At the conclusion of the training period each group of animals was divided into two sub-groups. *Ss* were placed on 20-hour water deprivation and one sub-group of each pair was given four trials to water reward in the black alley of a *Y* maze and the other sub-group was run to the white alley of the maze.

The results of the test trials indicated that secondary reinforcement was functioning differentially for the sub-groups. Significant differences were obtained between the sub-groups which were run to the same color in which they had received the preferred food and those which were run to the color in which they had received the non-preferred food. No significant differences were obtained between the sub-groups which received both foods in the black and white box.

The results of the experiment appear to support the hypothesis that the strength of secondary reinforcement varies as a function of the quality of food reward.

References

1. D'Amato, M. R. Transfer of secondary reinforcement across the hunger and thirst drives. *J. Exp. Psychol.*, 1955, **49**, 352-356.
2. Estes, W. K. A study of motivating conditions necessary for secondary reinforcement. *J. Exp. Psychol.*, 1949, **39**, 306-310.
3. ———. Generalization of secondary reinforcement from the primary drive. *J. Comp. & Physiol. Psychol.*, 1949, **42**, 286-295.
4. Goodson, F. E., Lewis, G. W., & Kimball, R. R. Expectancy and the extinction of expectancy in the hooded rat. (Unpublished study.)
5. Hopkins, C. O. Effectiveness of secondary reinforcing stimuli as a function of the quantity and quality of food reinforcement. *J. Exp. Psychol.*, 1955, **50**, 339-342.

Department of Psychology
Purdue University
Lafayette, Indiana

The Journal of Genetic Psychology, 1961, 98, 55-62.

EFFECT OF AMOUNT AND PERCENTAGE OF REINFORCEMENT ON RESISTANCE TO EXTINCTION IN PRESCHOOL CHILDREN*

Department of Psychology, University of Washington

DONALD K. PUMROY AND SHIRLEY S. PUMROY[1]

A. INTRODUCTION

Until recently there have been only a few experiments investigating hypotheses derived from animal studies using young children in the operant or instrumental conditioning situation. Mitrano (5) was concerned with applying Pavlovian principles to the token reward situation using feebleminded children as subjects. Warren and Brown (8) constructed a Skinner box for children and followed the traditional procedures used in such animal investigations. Siegel and Foshee (7) investigated the relationship between resistance to extinction and number of reinforcements using a bar pressing apparatus with candy as an incentive. Their subjects were divided into four groups receiving, respectively, 2, 4, 8, and 16 reinforcements. Resistance to extinction was positively related to number of reinforcements. Caditz (2) studied the responses of preschool children in a lever pressing situation in which the reward was seeing a colored ball fall into a glass jar. One group was given 100 per cent reinforcement, and the other 33⅓ per cent. The 33⅓ per cent group made significantly more responses during extinction than the 100 per cent group.

Bijou (1) studied preschool children using a ball dropping response with trinkets as rewards. One group received 100 per cent reinforcement and the other 20 per cent. Number of trinkets was the same for both groups, six trinkets. The 20 per cent reinforcement group made more responses during a 3 and ½ minutes extinction period than did the 100 per cent group.

The purpose of this study is, to investigate the effects of (*a*) amount of reinforcement on extinction and (*b*) different percentages of reinforcement on extinction using preschool children as subjects.

* Received in the Editorial Office on May 20, 1959.

[1] This article is based on two dissertations prepared under the direction of Dr. S. W. Bijou and submitted to the faculty of the Department of Psychology of the University of Washington in partial fulfillment of the requirements for the Ph.D. degree. The authors wish to express their appreciation to Dr. S. W. Bijou for his guidance and encouragement and to Dr. A. L. Edwards for his statistical assistance.

B. Method

1. *Subjects*

The subjects were 48 nursery school children whose ages ranged from 35 to 65 months with a median age of 48.5 months. There were 27 boys and 21 girls. None of the children were considered to be deviant either physically or emotionally. Each subject served in both experiments, with approximately one month between first, in the amount of reinforcement (*a*), then the different percentage of reinforcement (*b*).

2. *Apparatus*

A fuller description of the apparatus is presented by Bijou (1). It is essentially a large wooden box so designed that a small rubber ball (Spalding regulation hand ball) dropped through a hole in the upper portion of the box, is delayed for four seconds within the box, and then released, so that it rolls out of a second opening in the lower portion of the box. The ball then comes to rest in a receptacle in front of the lower opening and is available for the next response. On reinforced trials a trinket[2] is mechanically dropped from inside the box into a clear plastic enclosed box to the left of the child. A polygraph was used to record the number of responses and reinforcements.

3. *Procedures*

Each child went through a preliminary play period with a toy designed to put the child at ease in the experimental situation. He was then told, "Now let's play another game" and seated in front of the apparatus which, up to this point, was covered with a wooden screen. The *E* showed the child a tray of trinkets and said, "You can have some of these to take home with you, if you put the ball in here (pointing to the plastic box). Go ahead and try it. You may take them with you when you are all through." In both parts of the study each child served as his own control.

In studying the effects of amount of reinforcement four different amounts of reinforcement were used (1, 3, 5, and 7 trinkets) and each child was given the same number of trinkets. There were 48 subjects so each of the 24 possible permutations was present twice. The 24 different permutations were randomly assigned to individual children. After a particular reinforcement condition a two-minute extinction period ensued, followed by

[2] The trinkets were purchased from Viking, 530 Golden Gate Avenue, San Francisco 2, California.

the next period of reinforcement. This period of reinforcement was in turn followed by a two-minute extinction period. In this manner the child proceeded until he had completed the four periods of extinction. The measure of resistance to extinction employed was the number of responses made during the two-minute extinction period.

The procedure and design for studying the effects of the different percentages of reinforcement were similar to that described for the first part of the study. The same completely balanced Latin Square design was used. Here the number of trinkets given in each reinforcement period was held constant (three) and the percentage of responses reinforced varied. The percentages of reinforcement were: 16⅔, 33⅓, 50, and 100.

C. Results

The 24 permutations of the four different amounts of reinforcement resulted in six Latin Squares. Each of these Latin Squares was replicated once and the resultant data submitted to analysis. The results of this analysis are presented in Table 1. An inspection of Table 1 reveals that the effect of amount

TABLE 1
Analysis of Variance for Effect of Amount of Reinforcement

Source	df	MS	F
Total	191	22.34	
Subjects (S)	47	74.80	
Order (O)	23	55.83	
S Same order	24	92.99	
Extinction periods (E)	3	32.95	8.14**
S × E	141	4.63	
O × E	69	5.17	
Amounts of reinforcement	3	30.98	7.65**
All other interactions	138	4.05	

** Significant at .01 point.

of reinforcement was significant at beyond the 1 per cent point. This indicates that the total number of responses during extinction was positively related to the number of reinforcements. Following 7 reinforcements there was a total of 435 responses, 5 reinforcements produced 446 responses, 3 reinforcements 419 responses, and following the single reinforcement were 368 responses.

The analysis also indicated that successive extinction periods regardless of the number of reinforcements in the preceeding reinforcement period, also had a significant effect on the number of responses. There were 363 re-

sponses emitted in the first extinction period, 463 in the second, 452 in the third, and 435 in the fourth.

1. *Effect of Different Percentages of Reinforcement*

The effects of the different percentages of reinforcement was analyzed in a similar manner. These results are presented in Table 2. Table 2 shows that the different percentages of reinforcement have a significant effect upon

TABLE 2
ANALYSIS OF VARIANCE FOR EFFECT OF PERCENTAGES OF REINFORCEMENT

Source	df	MS	F
Total	191	15.54	
Subjects (S)	47	47.81	2.06*
Order (O)	23	73.48	3.17**
S same order	24	23.21	
Extinction periods (E)	3	13.10	2.91*
S × E	141	4.84	
O × E	69	4.66	
Percentage of reinforcement	3	20.39	4.53**
All other interaction	138	4.50	

* Significant at .05 point.
** Significant at .01 point.

extinction responses. The greatest number of responses was made following the 100 per cent reinforcement [+489]. In order of number of extinction responses the other percentages of reinforcement were: 50 per cent reinforcement [+481], 33⅓ per cent reinforcement [+463], and 16⅔ per cent reinforcement [+419]. Successive extinction periods also have an effect on the number of responses; more responses were made during the first extinction period and fewer on subsequent extinction periods. Table 2 also indicated that subjects and the order in which the different percentages were presented cause a significant variation from child to child in total number of responses. The inspection of the data suggests that when the children received the 16⅔ per cent reinforcement condition first they tended to give either many more or fewer responses than children who received some other percentage of reinforcement first.

D. DISCUSSION

1. *Effect of Amount of Reinforcement*

The effect of amount of reinforcement on the number of extinction responses in this study is in agreement with the results of other experiments

in the same area. That is, the more reinforcements the children received the more responses they made during the extinction period. This finding is similar to that found by Perin (5) and Williams (8) and probably most comparable to that of Siegel and Foshee (7), who used children as subjects. Even when compared with the Siegel and Foshee study there are important methodological differences, however. Siegel and Foshee used different groups of children while the present study employed each child as his own control. There were also differences in the type of reward and how it was administered. Siegel and Foshee used candy which the child could consume as soon as it was given. In the present study the reinforcements were small trinkets which accumulated until the experiment had been completed. Even with these differences it appears that the reinforcement principle is applicable to these conditions as well.

It is to be noted that the effect of the different extinction periods, regardless of the amount of reinforcement, was significant. The fewest number of responses was made during the first extinction period with a larger and constant number being made during the second, third, and fourth periods. The reason for the few responses following the first extinction period may be that the children were not familiar with the procedure and apparatus at that time. By the time of the second extinction period they were familiar with the situation and had learned to respond more rapidly.

2. *Effect of Different Percentages of Reinforcement*

There was a significant difference between the number of responses following the different percentages of reinforcement. The most responses were made in the following order; 100 per cent, 50 per cent, 33⅓ per cent, and 16⅔ per cent. This differs from what has been found in most of the studies using different percentages of reinforcement. Most studies appear to be consistent with Grant and Schipper's (3) statement that "the greatest resistance to extinction is between 50 and 80 per cent." It is difficult to compare the present experiment with many of these experiments because of the difference in subjects, reinforcements, and design. Probably the most similar in design although just the reverse in results is the study done by Bijou (1). This study was quite comparable as he used similar subjects, apparatus, and reinforcements but found that the 20 per cent reinforcement group made significantly more responses during extinction than the 100 per cent group. One difference, however, was that his extinction period was of 3½ minutes duration while in the present study it lasted only 2 minutes.

If the extinction period had been longer than 2 minutes it is possible that the other conditions might have shown a greater resistance to extinction than the 100 per cent condition. It might be reasoned that, for example, the 50 per cent condition would respond during extinction at a slower rate but for a longer time; and, if extinction continued instead of being cut off at the end of two minutes, the 50 per cent condition would show more resistance to extinction. In this case it would be assumed that the 100 per cent condition would respond rapidly at the beginning of extinction and then have slowed down before the two minutes were over. In an attempt to determine if this might have been the case, the responses were tabulated for 30-second blocks for the 50 per cent and 100 per cent conditions. The results of this tabulation revealed that the assumption mentioned above was not justified. The 100 per cent condition did not respond more at the beginning and then slow down, nor did the 50 per cent condition maintain the same approximate number of responses for each of the four 30-second blocks. This finding does not, of course, rule out completely the possibility that the 50 per cent condition responds more after the two minute period than the 100 per cent condition.

Another difference between the present study and that of Bijou is that the present study used successive acquisition-extinction periods with each subject serving as his own control as compared with only one acquisition and one extinction period in Bijou's experiment. Another difference is that only three reinforcements were used in the present study while Bijou used six. There appears to be no other experiment employing so few reinforcements in studying intermittent reinforcement as were used in the present experiment. A portion of Humphrey's (4) study approaches this small number of reinforcements; he used seven reinforcements in 18 trials for one group and 18 reinforcements in 18 trials for the 100 per cent group. It should be noted that he used rats in a Skinner box and that, consequently, this experiment is not comparable with the present study. However, he found that there were no significant differences between these two groups in the amount of resistance to extinction. He suggested that the failure to find differences in resistance to extinction may be accounted for by the small number of reinforcements.

It is impossible to determine from the data what particular variables may account for the obtained results. These can only be ascertained by future research.

It is of interest to note the curves for the total number of responses in the successive extinction periods. It indicates that the subjects made fewer

and fewer responses as they proceeded through the four extinction periods. The data on the number of responses following the different amount of reinforcement is different from this in that it shows that fewer responses were made following the first extinction period. This difference may be accounted for by the fact that the subjects were first used in the different amounts of reinforcement section and only later in the effects of different percentages of reinforcement section. Consequently, during the study of different percentages of reinforcement they were familiar with the apparatus and technique.

E. Summary

The aim of this study was two-fold. The first was to determine the effect of different amounts of reinforcement of resistance to extinction and, secondly, to determine the effect of different percentages of reinforcement on resistance to extinction using preschool children.

The subjects consisted of 48 nursery school children, 27 boys and 21 girls. The apparatus was a plywood box with two holes, one above the other. The instrumental response employed was dropping a ball in the upper opening. The ball was held inside the box for four seconds at the end of which time it rolled out of the bottom opening and the response could then be repeated. On reinforced trials, a trinket was mechanically dropped into a plastic tray beside the plywood box. The child was allowed to take the trinkets with him at the end of the experiment. In each part of the study the child went through four successive periods of reinforcement and four two-minute extinction periods. Each child received the same total number of reinforcements, the order in which the acquisition periods were presented produced an experimental design consisting of six Latin Squares, representing all 24 permutations of the four amounts of reinforcement. These squares were replicated once, so that there were two subjects undergoing each of the 24 orders. The measure of resistance to extinction was the number of responses made during a two-minute period.

The investigation of the effects of different percentages of reinforcement was done in the same manner using the same subjects, about a month later. The different percentages of reinforcement studied were; 16⅔, 33⅓, 50, and 100 per cent.

The results of the effect of amount of reinforcement indicate that there is a significant positive relationship between number of responses and amount of reinforcement. There was also a significant difference in the responses

during the extinction periods. Far fewer responses occurred in the first extinction period than in the other three.

The results of the effect of the different percentages of reinforcement showed that the greatest number of responses were made following the 100 per cent reinforcement condition with a decreasing number of responses made after the 50, 33⅓, and 16⅔ per cent reinforcement conditions in that order. These differences were statistically significant. The subjects responded less and less in successive extinction periods.

These results were discussed and compared with related research.

References

1. Bijou, S. W. Patterns of reinforcement and resistance to extinction in young children. *Child Devel.*, 1957, **28**, 47-54.
2. Caditz, S. B. A study of partial reinforcement of a lever pressing response in young children. (Unpublished Master's Thesis, University of Washington, 1953.)
3. Grant, D. A., & Schipper, L. M. The acquisition and extinction of conditioned eyelid responses as a function of the percentage of fixed ratio random reinforcement. *J. Exp. Psychol.*, 1952, **43**, 313-320.
4. Humphreys, L. G. The strength of a Thorndikian response as a function of the number of practice trials. *J. Comp. Psychol.*, 1943, **35**, 101-110.
5. Mitrano, O. J. Principles of behavior in human goal behavior. *Psychol. Monog.*, 1939, **51**, No. 4 (Whole No. 230).
6. Perin, C. T. Behavior potentiality as a joint function of the amount of training and degree of hunger at the time of extinction. *J. Exp. Psychol.*, 1942, **31**, 93-113.
7. Siegel, P. S., & Foshee, J. G. The law of primary reinforcement in children. *J. Exp. Psychol.*, 1953, **45**, 12-14.
8. Warren, A. B., & Brown, R. H. Conditioned operant response phenomenon in children. *J. Gen. Psychol.*, 1943, **38**, 184-207.
9. Williams, S. B. Resistance to extinction as a function of the number of reinforcements. *J. Exp. Psychol.*, 1938, **23**, 506-522.

Department of Psychology
University of Maryland
College Park, Maryland

The Journal of Genetic Psychology, 1961, 98, 63-67.

STUDENT SELF ESTIMATES OF FINAL COURSE GRADES*

School of Education, The University of Buffalo

EUGENE L. GAIER

A. PROBLEM

For the university student, the variables involved in the assignment of of final course grades range from the objective, predictable total of course tests and assignment totals on the one hand, to the mysterious, unpredictable, and erratic on the other. Results based on calculations derived from the normal curve distribution, class comparisons, test performance, interpersonal relationships, teacher-student personality similarities (Hamlish and Gaier, 1954), being able to outguess the teacher, plus a multiplicity of others, have all been offered as contributing influences in the assignment of final course grades (Brim, 1954; Brown, Abelis, and Iscoe, 1954; Gaier, 1952; Simpson, Gaier, and Jones, 1952).

The purpose of the present study was two-fold: to examine what grades students felt they deserved in a course and the degree of accuracy between the grades and those actually assigned; and second, to examine the kinds of support and reasons students martialed as to why they believed they should be assigned a specific course grade. It was initially assumed here that the estimates made by both students receiving high and low grades would be closer in their approximation to the actual grade received. Those in the middle range would be more erratic in their predictions. Furthermore, these differences would become manifest in the orientation of reasons submitted to support the grade selected.

B. SUBJECTS AND PROCEDURE

As the last question of a final examination, 132 undergraduates enrolled in sections of a course in Adolescent and Educational Psychology were asked to complete the following: "Please state the grade you believe you deserve in this course (not need) and list the reasons you believe you should be assigned this grade." The data for the present study consist of the responses made by the subjects.

* Received in the Editorial Office on May 21, 1959.

C. Results and Discussion

The responses obtained from the 132 subjects were classified into three major categories based on the actual course grade assigned by the instructor. These divisions included: High (H) based on an assigned grade of A or B; Middle (M) based on the grade of C; and Low (L) based on the actual grades of D or F.

Pearson correlation coefficients between assigned grades and expected grades yielded values of .78, .44, and .65 for the High, Middle, and Low groups, respectively. These values were all significant beyond the one per cent level of confidence, indicating that while the students' self estimates were significantly better than chance, the middle range of students was less capable, as a group, in estimating final performance than either of the High or Low groups.

On the basis of the differences found in the accuracy of prediction of final course grade, a systematic classification of the reasons cited in support of estimated course grade was carried out. A two-fold approach was employed here: Objective and Subjective reasons. In the Objective category were contained those reasons characterized as external or independent of the personal self. Here, the appeal was usually coached in terms of a previous achievement in the course, based on observable and often checkable data. The Subjective category was composed of reasons exhibiting or affected by personal bias, emotional appeal, wishful thinking, over-interpretation of class experiences and a type of magical thinking. Examples of each of the categories are as follows:

Objective: "My examination grades were all *B*. If I get a *B* on this exam, I should get a *B* in the course." "Assuming that I get a *C* on this exam, it should average all of my other grades up to a *C*."

Subjective: "I came to all the lectures and read the book. I always get a *C* when I do this in my other courses." "I guess I should flunk this course, but if my professor could just lift the 'curve,' I'd be very happy. I have to make a *C* average this semester." "I guess I deserve an *F*, but honestly, I have gained a great deal from your lectures and the book. Actually, I have tried, but for some reason my efforts have been in vain. After failing three tests, I'm certain that I deserve the grade I get. It is not that I haven't enjoyed the course, because I have, and feel I have gained from it. Grades are not always what they seem. Of course, I would be pleased with any grade above *F*; of course, I don't mean an *A* or *B*."

A total of 333 responses, 274 classified as objective and 59 as subjective,

was presented by the subjects. The reasons were classified by two psychologists and a reliability of .986 was obtained, indicating a high degree of agreement in actual categorization of the responses.

A test of chi squared was applied to the total of Objective and Subjective obtained frequencies. From the results presented in Table 1, it may be seen that the value ($X^2 = 13.49$, $df = 2$) was significant at beyond the one per cent level. An examination of Table 1 indicates the sum of the

TABLE 1
FREQUENCIES OF HIGH, MIDDLE, AND LOW RANKING STUDENTS OF ESTIMATED AND RECEIVED GRADES
($N = 132$)

Response	High ranking	Middle ranking	Low ranking	Total
		Obtained frequencies		
Objective	110	123	41	274
Subjective	29	25	5	59
Total	139	148	46	333
		Cell-square contingencies		
Objective	.16	.01	.27	.44
Subjective	.75	.06	12.24	13.05*
Total	.91	.07	12.51*	13.49*

* Significant at beyond the one per cent level.

cell-square contingencies for the subjective responses was 13.05 ($df = 2$), a value also significant at beyond the one per cent level. That a difference exists between the three grade groups in the appeal to subjective factors appealed to in support of grade choice is supported by these results. Further examination of the cell-square contingencies for the three groups in the citing of subjective responses points up a marked difference between the Low group on the one hand, and the Middle and High group on the other. That the students receiving lower grades differ from the other students in the appeal to subjective reasons is further borne out by the value of the sum of the cell-square contingencies.

Cell-square contingence value equals 12.51 ($df = 1$) for the low group contrasted with values of .91 and .07, respectively for the high and middle group, the latter two values not significant. That the low group differs from the other two groups is apparent, but this group does not differ significantly in the use of objective reasons when compared with the other two groups.

In general, the present subjects do not appear to differ significantly from each other in the use of objective factors in estimating final grades. High,

middle, and low ranking students appeared similar in their reliance and appeal to objective criteria in estimating final grades. What does emerge, however, is that the low ranking group was less subjective in estimating grades. The following excerpts, two from the high-ranking group and two from the low-ranking group indicate the differences in orientation in the use of appeal to subjective factors:

High-Ranking Student (B): "I think that I deserve a *B*. Why? Well, the only reason I can think of is that I would really like one. Besides, believe it or not, I did read the books and do understand a great deal more on the completion of the course."

High-Ranking Student (A): "Considering previous grades, if I make an *A* on the exam, I should get an *A*. If I make a *B*, I should have a *B* in the course. I'm not considering anything lower, or rather, I'm just not thinking about it."

Low-Ranking Student (D): "I believe I deserve a *D* in the course according to my average, although my discussion today was particularly bad on the examination questions."

Low-Ranking Student (F): "I consider that a *D* for my grade would be satisfactory. Because even though my grades don't show that I deserve a *D*, I figure that I learned enough out of this subject to get a *D*. Also, if I flunk this course, I will not be able to graduate next June. And if I get a *D*, I will be the happiest person and also I would really have a happy summer."

Because of past experiences, students who expect lower grades perhaps accept their fate more passively without resorting to as much rationalization as the other students.

D. Summary and Conclusions

In an attempt to examine the relationship between students' estimates of course grade and final performance, 132 undergraduates were asked to estimate their final grades in a course in Adolescent Psychology as well as the reasons they believed they deserved this grade. On the basis of the obtained data, the following conclusions appear warranted:

1. High-ranking students appear most capable in estimating final course grades. Middle-ranking students are least accurate in their predictions.
2. Low-ranking students tend to present less subjective reasons to support their course grade estimate.
3. No significant differences were found among the three groups, middle, high, and low, in the use of objective reasons to support their selection of a course grade.

References

1. Brim, O. G. Junior college grades and self-estimates of intelligence. *J. Educ. Psychol.*, 1954, **45**, 477-484.
2. Brown, W. F., Abelis, N., & Iscoe, I. Motivational differences between high and low scholarship students. *J. Educ. Psychol.*, 1954, **45**, 215-233.
3. Gaier, E. L. Selected personality variables and the learning process. *Psychol. Monog.*, 1952, **66**, No. 17 (Whole No. 349).
4. Hamlish, E., & Gaier, E. L. Teacher-student personality similarity and grades. *Sch. Rev.*, 1954, **62**, 265-273.
5. Simpson, R. H., Gaier, E. L., & Jones, R. S. A measure of resourcefulness in attacking professional problems. *Sch. Rev.*, 1952, **60**, 535-540.

School of Education
The University of Buffalo
Buffalo 14, New York

The Journal of Genetic Psychology, 1961, 98, 69-82.

SUBCULTURAL VALUES AND IQ STABILITY*

Psychological Center, Graduate School of Education, Yeshiva University

BORIS M. LEVINSON[1]

A. HYPOTHESIS

Our hypothesis is that: (*a*) every subculture envisages an "idealized" personality molded to its own survival needs; (*b*) the social need to approximate this "idealized" personality creates cultural pressures which, in time, are a selective force in the development of certain psychological abilities; (*c*) each subculture encourages and perpetuates those abilities which are important for the growth and development of the group; and (*d*) the process through which the subculture shapes the personality has a significant relationship to intelligence (a most important factor in personality development) and must, therefore, be evidenced in terms of intelligence test scores.

B. PROBLEM

If our hypothesis is valid, as this writer believes, it raises a very important question as to the concept of IQ stability i.e.: "Under what conditions may the IQ remain stable in a deviant culture and particularly in a deviant subculture of a dynamic society?"

C. METHOD

1. *The Setting*

Psychologists originally thought of themselves as natural scientists and spoke in terms of "laws of development." Because the human being is a biological organism which develops physical abilities (sitting, standing, walking, running, etc.) according to ascertainable "laws" of organic development; psychologists assumed that the growth and development of intelligence followed analogous measurable and predictable patterns. They overlooked, thus, the fact that conation, conception, and even perception, which are just a few of the important mental processes, depend for their growth largely upon the environmental situation and its stimulation of the mind.

* Received in the Editorial Office on May 22, 1959.

[1] The writer wishes to express his appreciation to his graduate students, Dr. M. Brayer, Rabbi Z. Block, and Mrs. Frieda Rabinovitz, who have done the follow-up testing, and to Mrs. Madeline Greenberg who has done the tabulation of the data and most of the statistical computations.

If the assumption that our society is "static" and has stable values were not implicit in the standardization of intelligence tests, it would be impossible to continue to use the same tests over a period of years with any expectations of valid results. The psychologist further assumes that any changes which may be occurring in the organism, as well as the environment, will balance off each other and have a correspondingly levelling effect on various tests. The fact that a certain stability of IQ is found when large samples of the population are being retested may be considered a serious challenge to the hypothesis we have stated above. In our opinion, however, this is due to the fact that (*a*) in a sample coming from different subcultures some subjects may increase while others decrease their IQs so that the average remains the same, or (*b*) the sample comes from the same subculture upon which the test was standardized and the values of this group have not changed meanwhile.

When large, unexplained, and perplexing differences in the IQ are found in large samplings, it might uncover some new facts to question the very concept of IQ stability rather than seek an explanation, as has been the practice, by looking for artifacts either in the instrument (test used) or in the individual. When psychologists have accepted the fact that our society is dynamic and that different strata of society live in subcultures which vary in their dynamic and static structure, these variations and changes in IQ will be expected and will become explainable. It must then become apparent, we believe, why a test consisting of various subtests measuring different abilities and standardized on the assumption of a static society will of necessity yield different results when applied to a variant group. By properly orienting to a dynamic society, the meaning of test scatter, which has until now indicated only in very general terms an increase or decrease in certain abilities, will become much more meaningful. It is our belief that it may even become possible to use this scatter for more accurate measurement of the subject's acceptance or rejection of the dominant values of his or her subculture. It may be, for example, that the increase of IQs among some bright children and the decline of IQs among some dull children will come to mean the respective acceptance and rejection, by these children, of the goals and values in their environments.

To summarize: In our opinion, it is like looking for a will-o-the-wisp to search for the answer to the problem of IQ stability in some abstract concept. In order to validate the stability of IQ one must first determine: (*a*) the values of a particular group, and (*b*) devise tests which will measure those psychological abilities which express these values. This would involve a

determination of the norm of achievement for the particular subculture at various grades or ages, etc., (*c*) making certain that for the group in question these values are constant, and (*d*) determining the new values, direction of change, and devising items to measure the changing personality variables in a dynamic society. By working with these premises the psychologist will consciously attempt to do something which, until now, he has unconsciously tried to accomplish by having his scale express societal values. The intelligence scale thus devised will be a glorified achievement test showing, in stark light, the proportion of our population who have assimilated and acted upon the important values of the group.

On the basis of the above, we would readily be able to predict for a subgroup, once their value orientation was known, that the IQ will remain constant, decline, or even increase. It would not surprise us, for instance, to find that the upper mobile sections of our society whose values correspond more closely to the evolving values of society (which in turn depend upon new societal needs) show an ascending IQ pattern. On the other hand, that stratum of society which is bound by less functional, or no longer functional values, will demonstrate either a static or declining IQ.

Therefore, a test consisting of various subtests measuring different psychological functions and standardized on the basis of society being static, can be used with a deviant subculture to show either increase or decrease or stability of IQ. The item selected will determine whether the IQ is stable; i.e., the increase, decrease, or stability of IQ will depend upon the item which is used to measure it. Since a judicious selection of test items can bring about the proof of any theory, the value judgment of the psychologist becomes a matter of extreme importance determining, in the last analysis, the selection of proof of either the constancy or variability of IQ for any particular population.

In order to test our hypothesis, we decided to make a follow-up study of children to whom WISC was administered in 1956-57 and whose performance on these tests was reported in a previous paper (Levinson, 1960a). These children were applicants for admission to day Yeshiva schools. The *raison d'être* of the day Yeshiva school is the perpetuation of the Jewish religion and the Jewish people through emphasis upon those values considered essential to the successful attainment of these goals. Since verbal ability is of utmost importance to this group, and is stressed throughout the curriculum, it was our expectation that we would find a significant increase in verbal scores accompanied by a minimal increase in performance scores among these subjects.

2. *Previous Research*

Numerous studies have been made dealing with IQ constancy (Clark, 1959; Honzik, 1938; Honzik, 1948; Thorndike, 1940). Due to limitations of space only a few that are most germane to our inquiry will be mentioned here. It has also been noted by previous investigators that in some groups there appeared to be no stability of IQ (Goldfarb, 1955; Gordon, 1923) but the theory of IQ constancy was not questioned. Instead, other factors were drawn in to explain the deviant results.

From time to time various explanations have been proposed for IQ inconsistencies. McNemar (1942), for example, suggested that IQ constancy may be maintained if: (*a*) the same general intellectual ability is called for at various age levels; (*b*) the standard deviation of successive IQ distributions are equal; (*c*) IQs and age are uncorrelated; (*d*) growth rate of all individuals remain the same. Roff (1941) felt that the constancy of IQ is largely due to the retention by the examinee of skills and knowledge "which helped him to achieve a previous rating." Conversely, it was felt by other investigators that a change in IQ was due to: (*a*) errors of measurement; (*b*) changes in the rate of mental development produced by changes in the emotional and cultural climate, or the development or correction of a physical handicap; (*c*) changes in the rate of mental development despite a relative constancy of environment.

3. *Studies in Day (Yeshiva) Schools*

Several studies (Levinson, 1958, 1959a, 1959b, 1960a, 1960b) have shown that the verbal IQs are significantly higher than the performance IQs among Jewish elementary, high school, and college students from traditional backgrounds. These findings gave rise to various beliefs about the Yeshiva day school such as that: (*a*) it serves as a selective agent for those with higher verbal ability; or (*b*) since most children who attend the Yeshiva day schools are bilinguals, verbal ability is not a valid criterion (due to language handicaps) for them; whereas their performance ability was an adequate indication of their actual ability as evidenced through the original testing which showed them to be doing as well in performance as in verbal areas; or (*c*) that the differences found are really sex differences since most of the research is based on findings with boys; or (*d*) the day school favors the development of verbal as against performance ability.

Until the investigation reported in this study, the findings in intelligence of Jewish subjects of traditional background were largely based upon cross-

sectional examinations. The writer believes that these are inadequate and would recommend that all future inquiries into test stability be based upon longitudinal rather than cross-sectional studies. One major flaw in cross-sectional studies which cannot be over-stressed is that all possibility of corroboration by professional colleagues is eliminated because they can seldom be duplicated. Of equal or even greater importance is the fact that the differences observed in a cross-sectional study can be the result (and likely are) of the somewhat different worlds in which the subjects live rather than changes, per se, in mental abilities.

4. *Stability of WISC IQs*

The WISC was standardized on the basis of a constant SD at every age level so that any change in IQ should indicate a change in ability rather than changes due to the artifacts of the scale. Wechsler (1958) indicates that this method of calculating IQ permits the IQ to remain at a fairly constant level. Wechsler (1949) reported a reliability of .92 for the Full Scale WISC. Gehman and Matyas (1956) administered the WISC to 60 children in the fifth grade and readministered the test four years later to the same children in the ninth grade and found that the IQ was relatively constant.

D. Results

We were able to locate only 54 of the original subjects when we proceeded with the follow-up study. This represents a drop-out rate of 53.5 per cent which, it seems fair to assume, is due to (*a*) rapid change in the ethnic structure of the population in a relatively short time in certain sections of New York City. Another contributing factor is the tendency of some parents to remove their children from day schools after the kindergarten and first grade. We wished therefore, to find out whether the experimental group was representative of the original population.

Table 1 indicates that while the mean IQ of the experimental group is lower than that of the parent population, this difference is statistically insignificant. The sample studied is thus representative of the original population. We may note, however, that the differences between IQs was larger for the monolingual than for the bilingual children, and that a larger number of monolingual children dropped out. This may possibly be due to the fact that the parents of the bilingual children were more attached to the values of the school, or were not able to leave the district as readily.

We also considered the possibility that the children who remained had higher verbal than performance ability, and that, therefore, the difference found was merely an artifact of the remaining sample.

TABLE 1
SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE MEANS OF THE WISC IN 1956-57 AND 1958-59

	1956-57		*1958-59*				
	N	Mean	N	Mean	Diff	SEd	t
Boys	58	109.46	27	106.85	2.61	4.24	.62
Girls	59	101.85	27	99.93	1.92	2.18	.88
Monolinguals	57	108.68	19	105.89	2.79	3.70	.75
Bilinguals	60	102.72	35	102.03	.69	2.83	.02
Total	117	105.62	54	103.39	2.23	2.45	.91

Table 2 shows the differences between the means of the verbal and performance IQs for the sample in 1956-57 both for the boys and girls and monolinguals and bilinguals. It may be noted that the monolinguals had a mean difference of 1.42 IQ points in favor of performance scores. However, the bilingual children had a mean difference of 1.29 IQ points in favor of the verbal scores. The boys had a mean difference of 3.03 IQ points in favor of the verbal and the girls had a mean difference of 2.37 IQ points in favor of the performance scores. In all these cases the differences were statistically insignificant.

TABLE 2
THE DIFFERENCES BETWEEN THE MEANS OF THE VERBAL AND PERFORMANCE IQs IN 1956-57

	N	Verbal	Performance	Diff.	SEd	t
Monolinguals	19	104.63	106.05	1.42	6.3	0.23
Bilinguals	35	102.60	101.31	1.29	3.7	0.35
Boys	27	107.44	104.41	3.03	5.8	.52
Girls	27	99.19	101.56	2.37	2.8	.85

Another possibility considered was that this increase was merely an exacerbation of sex differences and was not at all due to other influences.

An examination of Table 3 indicates that there was an increase both in boys' and girls' scores. The increase both for boys and girls was statistically significant at the .02 or .01 level in WISC Full and WISC Verbal scales. The increase in WISC Performance Scale was statistically insignificant. Parenthetically, we may note that the boys had higher scores than the girls continuing the trend noted in a previous study (Levinson, 1960a). It is

interesting to note that similar findings regarding sex differences in achievement test scores were made in Israel (Anonymous, 1959).

TABLE 3
SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE MEANS OF THE TESTS TAKEN IN 1956-57 AND 1958-59 BY THE BOYS AND GIRLS

	N	1958-59	1956-57	Diff.	SEd	t
		Boys				
WISC Full	27	114.07	106.85	7.22	2.74	2.64*
WISC Verbal	27	119.26	107.44	11.82	3.83	3.09**
WISC Performance	27	105.41	104.41	1.00	2.38	.42
		Girls				
WISC Full	27	107.30	99.93	7.37	2.18	3.38**
WISC Verbal	27	109.63	99.19	10.44	3.38	3.09**
WISC Performance	27	103.11	101.56	1.55	2.03	.76

* .02 level of confidence.
** .01 level of confidence.

An examination of Table 4 indicates that the boys have significantly higher verbal scores than the girls. The question which may be raised at this point, is why the girls show any differential increase in verbal IQs, since the boys are the ones who are usually the favored ones in the Jewish traditional homes. It seems to the writer that the girls, too, are most eager to bask in some of the boys' glory and to receive adulation and rewards for scholastic success. Both groups have high achievement needs. Furthermore, here, too, as was found elsewhere (Lynn, 1959) there was an identification with the male by girls who chose to identify with male symbols.

TABLE 4
SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE MEANS OF THE TESTS OF THE BOYS AND GIRLS

	N	Boys	Girls	Diff.	SEd	t
WISC Full	27	114.07	107.30	6.77	3.9	1.74
WISC Verbal	27	119.26	109.63	9.63	4.0	2.41*
WISC Performance	27	105.41	103.11	2.30	3.7	.62

* .05 level of confidence.

A study of our sample (Table 1) indicated that most of the monolingual children dropped out and most of the bilingual children remained in school. The possibility must, therefore, be entertained that the increase in verbal tests is an artifact due to the possibility that the original verbal test scores for the bilingual group were unduly depressed. The resulting increase would then, not at all, be due to the effect of Jewish cultural values, but rather

to the fact that these children learned English. Hence, their current IQ ratings reveal their actual potential. Since, on the other hand, the performance IQs were fair to these bilingual children, the fact that there are statistically significant increases in verbal subtests and statistically insignificant increases or decreases in performance subtests, would merely demonstrate that the original rating obtained by these children was not a fair one, and that there was no increase in real ability. However, since a study by the writer has shown (Levinson, 1959a) certain verbal and performance subtests, viz: Information, Comprehension, Similarities, Picture Completion, Block Design, Object Assembly, and Coding to be fair to the bilingual native born Jewish child, these hypothetically should show no significant changes with time. The current follow-up study has shown, however, statistically significant changes in some of these subtests (see Table 7) which seem to indicate the operation of factors other than bilingual.

The first question to which we must address ourselves is whether for our sample there was a statistically significant increase in verbal scores for the bilingual children and a statistically insignificant increase in verbal scores for the monolingual children.

Table 5 indicates that there was a statistically significant increase in both monolingual and bilingual verbal scores. The increase in performance scores

TABLE 5
SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE MEANS OF THE VERBAL AND PERFORMANCE SCALES FOR MONOLINGUAL AND BILINGUAL CHILDREN

	1958-59 N		1956-57 N		Diff.	SEd	t
		Monolinguals					
WISC Full	19	113.53	19	105.89	7.64	2.70	2.76*
WISC Verbal	19	117.63	19	104.63	13.00	4.58	2.83*
WISC Performance	19	107.37	19	106.05	1.32	1.60	.83
		Bilinguals					
WISC Full	35	109.14	35	102.03	7.11	2.26	3.15**
WISC Verbal	35	112.71	35	102.60	10.11	2.90	3.48**
WISC Performance	35	103.11	35	101.31	1.80	2.25	.80

* .02 level of confidence.
** .01 level of confidence.

was statistically insignificant. We may note that the increase in monolingual verbal scores was 13.00 and the corresponding increase for bilingual children was 10.11.

We may further note from Table 6 that while the monolingual children had higher scores than the bilingual, these differences were statistically not significant.

TABLE 6
SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE MEANS OF THE TESTS OF THE MONOLINGUAL AND BILINGUAL CHILDREN IN 1958-59

	Monolinguals N		*Bilinguals* N		Diff.	SEd	t
WISC Full	19	113.53	35	109.14	4.39	4.7	.93
WISC Verbal	19	117.63	35	112.71	4.92	5.1	.96
WISC Performance	19	107.37	35	103.11	4.26	3.6	1.18

The next problem is whether the found increases have any relation to previous findings (Levinson, 1960a).

Table 7 shows the significance of the differences between the means of the tests in 1956-57 and 1958-59. Analysis of Table 7 indicates a statistically significant increase in the scaled scores of WISC full, WISC verbal and Information, Similarities, Vocabulary and Coding (increase in IQ). A statistically insignificant increase in scaled scores in WISC Performance, Comprehension, Arithmetic, Picture Arrangement, and Block Design (possible IQ stability) and decrease in scaled scores of Picture Completion and Object Assembly (possible decrease in IQ). The changes in subtest scores, again, are not in the direction which might be expected if bilingual factors were solely operative. It appears, on the basis of this study, that, for our group, we may prove (*a*) either stability or (*b*) increase or (*c*) decline in IQ depending upon the items adapted to measure intelligence. In other words, stability of IQ for any particular subculture depends largely on the test items which the experimenter chose in measuring the intelligence of a particular group.

TABLE 7
SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE MEANS OF THE TESTS IN 1956-57 AND 1958-59

	N	1958-59	1956-57	Diff.	SEd	t
WISC Full	54	110.68	103.39	7.29	1.75	4.17*
WISC Verbal	54	114.35	103.11	11.24	2.46	4.57*
WISC Performance	54	104.26	102.98	1.28	1.55	0.83
Information	54	11.81	9.77	2.04	0.57	3.58*
Comprehension	54	12.39	11.48	0.91	0.58	1.57
Arithmetic	54	12.31	11.42	0.89	0.53	1.68
Similarities	54	12.31	10.38	1.93	0.60	3.21*
Vocabulary	54	12.85	8.79	4.06	0.91	4.46*
Picture Completion	54	10.30	10.82	—.52	0.43	—1.21
Picture Arrangement	54	11.22	10.66	.56	0.45	1.24
Block Design	54	10.32	10.02	.30	0.55	0.55
Object Assembly	54	9.59	9.98	—.39	0.45	—0.87
Coding	54	12.09	10.50	1.59	0.56	2.84*

* .01 level of significance.

E. Discussion

Two interrelated hypotheses which have a great bearing on our thesis should be examined: (*a*) Different curricula bring about change in IQ and also in organization of abilities, (*b*) differentiation of abilities due to age. The effect of different school curricula on intellectual development has been subjected to frequent examination. In 1942 the intellectual growth of children attending consolidated rural schools was compared with that of children going to one-room rural schools by Worbois (1942). He found significant gains in IQ among the children attending the consolidated schools and slight change or even a decline in IQ among the one-room school students. Since he equated environment and parental education, he attributed his findings chiefly to the differences in school environment. He assigned to the superior teachers and better teaching methods in the consolidated schools, the credit for children's intellectual improvement. Furthermore, in Holland, during the war, there was a decline in IQ because of poor schooling (de Groot, 1951); the mean IQ among applicants to an industrial training school being 97. It was found that this figure returned to the normal "100" IQ with the restoration of normal schooling. Vernon (1950) found that different methods of teaching affected the nature of mathematical abilities. Fillela (1960) likewise, found that organization of abilities was strongly affected by the curriculum the examinee pursued. These findings would seem to give inferential support to our hypothesis that with a change in value orientation in society, or in a subgroup, there is also a change in intelligence.

Garrett (1946) felt that abstract intelligence changes in its nature as age increases from a fairly unified and general ability to a loosely organized group of abilities or factors. However, his findings do not find general support elsewhere. Curtis (1948), for example, offered a different explanation indicating that the level of difficulty of the tests, rather than age, brings about the differentiation of abilities. The research findings, in general, do not seem to support either Garrett (1946) or Curtis (1948). We find, for example, that the intercorrelations of WISC subtests do not drop with age (Wechsler, 1949). Furthermore Chen and Chow (1948) found an increase in the general factor from the primary school grades through senior high school. Swineford (1949), who made a longitudinal study of 88 children in sixth and ninth grades, to whom the same tests were re-administered, also found an increase in the general factor.

Several other questions arise as a result of our study.

What are the criteria of intelligence for the Jewish traditional group? Is the WISC Verbal Scale an adequate test of intelligence? Does it measure the culturally accepted criteria of ability for this subculture? We do not wish, at this point, to become involved in the question of what "Intelligence" is. Since WISC Verbal correlates higher than WISC Performance with school grades for this particular group (we have evidence to substantiate this statement), it is a better test of intelligence for this group than WISC Performance. As the reader will note, we accept here the culturally defined criteria of intelligence.

Even granting this standard of intelligence, a question still remains. Has there been an increase in creativity among these children? Can they think more originally? Can they bring forth scientific contributions which they could not before? Is it not possible that this increase in IQ is related to an increased ability to absorb and regurgitate information obtained from books and teachers without any increase in original thinking.

Another perplexing question arises. How were these cultural forces mediated? How were they transformed into greater achievement by members of this ethnic group? It appears, of course, that the rise in verbal IQs is due to the school curricula, and home and community influences. Yet, this answer raises more questions than it answers. How did this change come about? What specific motivational, cultural, or personality factors brought this about?

The writer believes that the factors mentioned below, with some yet unknown, may explain this phenomenon. The Jewish traditional home which, as is well known, is mother dominated and mother directed, and in which the boy is given a special status, in which he is encouraged to discuss his learning problems with the adults, is helpful to learning. Further, a warm positive family atmosphere in which verbal learning is rewarded by love, admiration, and practically adulation, permits the child to identify positively with the adult whose greatest preoccupation is learning.

The activity in which the child is expected to engage and excel is, as far as the child is concerned, functional and utilitarian in the setting in which he operates (Sklare, 1958; Zborowski, 1952).

It is a commonplace that Jewish culture stresses need for high achievement. Successful competition for higher status can be achieved through learning, a visible symbol of which is higher grades. There is a constant search for meaning, for reasons, for contractual rights and obigations. In Jewish folk

tales, man argues with God about his decrees, and has legal disputes with the Deity, pointing out that the latter has violated his own contractual obligations into which he voluntarily entered with the Jewish people. The child who has grown up in such an atmosphere has a somewhat different concept of self. He accepts the subculturally held stereotype that, as a Jewish boy, he is smart and, therefore, should do well in his studies. He feels that the major road *for him* for self-realization lies in persistent study and this idea determines his behavior.

Possibly then these findings may be somewhat similar to *Kagans' et al.* (1958) that some relationship exists between personality needs and increased intellectual growth. Children who had maximum increases in IQ were those who, on the basis of projective techniques, had great need for achievement and had competitive strivings. Sontag *et al.* (1958) found that these children were more aggressive, competitive, and were initiators. Rosen (1956) found a significant relationship existing between achievement motivation and school performance in high school students. Value orientation did not relate to achievement.

We must also consider the fact that, superimposed upon personality needs arising from the culture are also the variables expressing cultural standards within which these needs could be met. Now, we do know that the traditional curriculum in the day school is highly verbal in content and neglects performance arts. These schools have double programs (Hebrew and secular) and the children are exposed to an avalanche of verbal material at the expense of performance arts.

F. Implications

It seems to the writer that this study raises certain issues fundamental to mental measurement. These are: (*a*) No assumption can be made that the same values will hold true for various subcultures in our society even though the subjects are of the same age. (*b*) With increase in age or experience, there is a change in values and so a test, which may have been a valuable measure of intelligence for younger people, may lose its discriminative function for older people. (*c*) With a change in life's experience and a change in needs, certain other areas of living come to the fore. There is a need for an adequate measure of these. (*d*) There is a need for developing and standardizing tests of mental ability geared to a dynamic society with norms for every subculture, sex, and age. It is only then, when such highly discriminating tests are devised, that we shall be able to derive adequate measures of the rise and fall of mental ability.

G. Summary

A study was made of the hypothesis that stability of IQ in a particular subculture will depend among other variables also upon the tasks which are considered as indicators of intelligence. If the tasks measure the indirect expression of the values of a given subculture and there is no change in these values, the IQ will remain stable. If there is an increasing emphasis in school or elsewhere on those values which are indirectly measured by the tasks in question, the IQ will rise. If there is a deemphasis on these values, the IQ will decline.

A re-examination in 1958-59 of Jewish children attending day (Yeshiva) schools to whom the WISC was administered in 1956-57 indicated that there was a statistically significant increase in WISC verbal scores. The increase in WISC performance scores was statistically insignificant, there being a decline of scaled scores on some of the performance subtests. The inference was drawn that a prior selection of test items without considering the values of the traditional Jewish subculture, might lead one depending upon the item selected, to believe in either increase or decrease or stability of IQ for this ethnic group. It is, therefore, necessary, in interpreting IQ changes to consider both the items composing intelligence scales as well as the values of the subcultures tested.

References

1. Anonymous. Intelligence levels among Israeli children. *Scopus*, 1959, **13** (1), 7.
2. Chen, T. L., & Chow, H. H. A factor study of a test battery at different educational levels. *J. Genet. Psychol.*, 1948, **73**, 187-199.
3. Clark, A. C. Developments and applications in the area of construct validity. *Rev. Ed. Res.*, 1959, **29**, 84-105.
4. Curtis, H. A. A study of the relative effects of age and test difficulty upon factor patterns. *Genet. Psychol. Monog.*, 1948, **40**, 99-148.
5. de Groot, A. D. War and the intelligence of youth. *J. Abn. & Soc. Psychol.*, 1951, **46**, 596-597.
6. Fillela, J. F. Educational and sex differences in the organization of abilities in technical and academic students in Columbia, South America. *Genet. Psychol. Monog.*, 1960, **61**, 115-163.
7. Garrett, H. E. A developmental theory of intelligence. *Amer. Psychol.*, 1946, **1**, 372-378.
8. Gehman, H., & Matyas, R. P. Stability of the WISC and Binet tests. *J. Cons. Psychol.*, 1956, **20**, 150-152.
9. Goldfarb, W. Emotional and intellectual consequences of psychologic deprivation in infancy: A reevaluation. *In* Hoch, P. H., & Zubin, J. (*Eds.*) *Psychopathology of Childhood*. New York: Grune & Stratton, 1955.

10. Gordon, H. Mental and Scholastic Tests Among Retarded Children: An Inquiry into the Effects of Schooling on the Various Tests. London: Educ. Pamphlets Bd. Educ., 1923, No. 44.
11. Honzik, N. P. The constancy of mental test performance during the preschool periods. *J. Genet. Psychol.*, 1938, **52**, 285-302.
12. Honzik, M. P., Macfarlane, J. W., & Allen, L. The stability of mental test performance between two and eighteen years. *J. Exp. Educ.*, 1948, **17**, 309-324.
13. Kagan, J., Sontag, L. W., Baker, C. T., & Nelson, V. L. Personality and IQ Change. *J. Abnorm. & Soc. Psychol.*, 1958, **56**, 261-266.
14. Levinson, B. M. Cultural pressure and WAIS scatter in a traditional Jewish setting. *J. Genet. Psychol.*, 1958, **93**, 277-286.
15. ————. A comparison of the performance of bilingual and monolingual native born Jewish preschool children of traditional percentage on four intelligence tests. *J. Clin. Psychol.*, 1959, **15**, 74-76. (a)
16. ————. Traditional Jewish cultural values and performance on the Wechsler tests. *J. Educ. Psychol.*, 1959, **50**, 177-181. (b)
17. ————. A comparative study of the verbal and performance ability of monolingual and bilingual native born Jewish preschool children of traditional parentage. *J. Genet. Psychol.*, 1960, **97**, 93-112. (a)
18. ————. Subcultural variations in performance and verbal ability at the elementary school level. *J. Genet. Psychol.*, 1960, **97**, 149-160. (b)
19. Lynn, D. B. A note on sex differences in the development of masculine and feminine identification. *Psychol. Rev.*, 1959, **66**, 126-135.
20. McNemar, Q. The Revision of the Stanford-Binet Scale. Boston: Houghton Mifflin, 1942.
21. Roff, M. A. A statistical study of intelligence test performance. *J. of Psychol.*, 1941, **11**, 371-386.
22. Rosen, B. C. The achievement syndrome: a psychocultural dimension of social stratification. *Amer. Soc. Rev.*, 1956, **21**, 203-211.
23. Sklare, M. (*Ed.*) The Jews: Social Patterns of an American Group. Glencoe, Ill: Free Press, 1958.
24. Sontag, L. W., Baker, C. T., & Nelson, V. L. Mental growth and personality development: A longitudinal study. *Monog. Soc. Res. Child Devel.*, 1958, **23**, (2).
25. Swineford, F. General, verbal, and spatial bi-factors after three years. *J. Educ. Psychol.*, 1949, **40**, 353-360.
26. Thorndike, R. L. Constancy of the IQ. *Psychol. Bull.*, 1940, **37**, 167-186.
27. Vernon, P. E. The Structure of Human Abilities. New York: Wiley, 1950.
28. Wechsler, D. Wechsler Intelligence Test for Children. New York: Psychological Corp., 1949.
29. ————. The Measurement and Appraisal of Adult Intelligence (4th ed.). Baltimore: Williams & Wilkins Co., 1958.
30. Worbois, G. M. Changes in Stanford Binet IQ for consolidated and rural one-room school children. *J. Exp. Educ.*, 1942, **11**, 210-214.
31. Zborowski, M., & Herzog, E. Life is with People. New York: International Univ. Press, 1952.

Psychological Center
Graduate School of Education
110 West 57th Street
New York 19, New York

The Journal of Genetic Psychology, 1961, 98, 83-88.

JAPANESE AND AMERICAN CHILDREN'S PERCEPTION OF PARENTS*

Department of Psychology, Vassar College

MISAO MATSUMOTO AND HENRIETTA T. SMITH

A. PROBLEM

The importance of the perceived environment and the effects of parental attitudes and behavior have long been recognized in studies of personality development. But very few studies have been made of the child's perception of his parents' attitudes and behavior. Meltzer (4), Gardner (2), and England (1) have used various techniques to investigate children's attitudes toward parents. These studies, however, were not designed to elicit the child's interpretation of parental behavior. Kagan (3) has studied this problem by means of a very brief interview.

The present study was an attempt to extend the techniques developed in these earlier studies into the area of measuring the child's perception and interpretation of parental behavior and roles. Japanese and American cultures were selected because they have areas with great similarities, especially since 1945, but have also been described as having quite different cultural themes and values. It is possible that parental behavior (whether similar or different) in the two cultures, would be perceived by the children as it related to the attitudes of the entire culture. The following hypotheses were derived to test this assumption: (*a*) the Japanese father is perceived as more authoritarian than the American father, and (*b*) Japanese children perceive distinctive family roles for each parent whereas American children perceive much overlapping.

B. METHOD

1. *Subjects*

Eighteen American children, 11 boys and seven girls from the fifth and sixth grades of a private elementary school, and 50 Japanese children, 25 boys and 25 girls, from comparable school backgrounds were given the questionnaire. All children came from similar economic backgrounds in which the fathers were in the professions or in business and the mothers were homemakers. All subjects had at least one sibling.

* Received in the Editorial Office on May 28, 1959.

2. *Procedure*

From a questionnaire devised and tried the previous year on 20 American children in the fifth and sixth grades, the present form containing 36 questions was developed. Questions were concerned with discovering the child's concept of each parent: (*a*) *As a person:* When you grow up, how would you want to be like your father (mother)? In what ways will you want to be different from him (her)? (*b*) *As a disciplinarian:* Who usually punishes you at home? How? Who excuses you more easily when you do something wrong? (*c*) *As a playmate:* How often does your father (mother) play with you? List all the games or ways your father (mother) plays with you. (*d*) *As an informal educator:* Who helps you with your homework? Who takes you on trips? What kinds of trips? (*e*) *As a caretaker* in the sense of giving money, caring for illnesses or minor physical or psychological problems in the child's life. (*f*) *As an affectionate adult.*

This questionnaire was given to the children in a single session in the classroom situation. Instructions made it clear that this was not a test but an individual opinion questionnaire for which there were no correct, or incorrect, answers. All questions asked by the children concerning meanings of the various items were answered as fully as possible without suggesting answers. The Japanese children were given the same questionnaire, translated into Japanese, under similar conditions. Both groups answered the questionnaire after a two-week holiday from school, Christmas vacation for the American children, and New Year's vacation for the Japanese.

C. Results

Because of the discrepancy in size of the two cultural groups, the answers to the questionnaire were analyzed in terms of percentages, and the significance of difference between proportions was computed.

Table 1 shows the percentage of American children who perceived each

TABLE 1
Perception of Parents' Roles by American Children

Activity	Father %	Mother %	p
Housework	21	100	$< .001$
Tending cuts	19	52	.02
Tending headache	46	91	$< .01 > .001$
Tending hurt feelings	47	84	.01
Sports with children	42	16	$< .05$
Quiet activities	0	34	$< .01 > .001$
Work with children	0	41	.001

parent as engaging in, or being primarily concerned with, certain forms of activity. It is clear that mothers were perceived to take the larger role in housework and the gentler forms of caretaking and quiet interactions. Fathers' role seemed to be predominantly that of playing with the children. The lack of differences perceived between parental roles, considering the large number of possible activities, is accentuated when Table 2 is examined.

TABLE 2
PERCEPTION OF PARENTS' ROLES BY JAPANESE CHILDREN

Activity	Father %	Mother %	p
Education	90	54	$< .01 > .001$
answers questions	78	30	$< .001$
knows lots of things	50	20	$< .02 > .01$
teaches how to do things	38	80	$> .001$
helps with hard lessons	92	36	$< .001$
knows social studies and science	14	92	$< .001$
Housework			
Medical care	32	90	$< .001$
cut finger	20	88	$< .001$
headache	32	84	$< .001$
hurt feelings	22	84	$< .001$
Lost something	12	0	.05
Engage in sports	50	20	$> .01$
Teaches games and sports			

Not only was there a wider range of activities clearly differentiated for parents by Japanese children, but also the father played a much more clearly defined role in the intellectual stimulation of his children. It should be noted, however, that in general both Japanese and American mothers engaged in highly similar activities.

From Table 3 it can be seen that in areas where both American and Japanese parents interacted with their children, there was a significantly higher degree of contact between American parents and their children than

TABLE 3
DIFFERENCES IN PERCEPTION OF PARENTS BY AMERICAN AND JAPANESE CHILDREN

Activity	AF %	JF %	p	AM %	JM %	p
Sports	42	8	.001	16	2	$< .02 > .01$
Quiet activities	92	2	$< .001$	86	24	$< .001$
Work with children	0	0	—	41	12	$< .01$
Reading to children	33	28	—	63	28	$< .01$
Teaches games	89	50	$< .01$	47	20	$< .02$

between Japanese parents and their children. It is also important to notice sex differences in the perception of parents. From Table 4, which presents only significantly different aspects, it can be seen that American girls perceived their mothers as somewhat more limited in interactions with them

TABLE 4
DIFFERENCES BETWEEN BOYS' AND GIRLS' PERCEPTION OF PARENTS IN AMERICA AND JAPAN

	Father			Mother					
Activity	JB %	JG %	p	AB %	AG %	p	JB %	JG %	p
Help with homework	32	68	.001	84	43	.05			
Sports				63	14	.001			
Work with children				9	72	.01	0	24	.01
Housework	24	4	.02						
Punish child	60	36	.05						
Excuses child	20	60	$< .01$				72	24	.01

than did boys. The nature of these interactions was also quite different. Similarly, Japanese girls saw their mothers as more restricting than did Japanese boys who perceived their fathers in this role.

It was also found that in the children's perceptions of their parents as persons American children tended to describe them in practical terms such as successful, handsome, and intelligent more frequently than did the Japanese children ($p = .001$). Japanese children described their parents by means of such subtle emotional and moral qualities as tender, gentle, quiet, sincere, and reliable more frequently than did American children ($p = < .001$).

Finally, it is relevant to notice the areas in which there were no significant differences in perception: (*a*) American children saw the mother and father as similar in educational functioning; (*b*) few children of either culture criticized their parents, but when such criticisms were made apparent there was no difference between sex of children or sex of parents; (*c*) Japanese and American children perceived no difference in parents' roles in medical care; and (*d*) all children clearly perceived the mother as the parent most involved in housework.

D. Discussion

The relationship between parents and children in Japan was one of stressing differences rather than of developing equality as in America. There was also a clear differentiation between the roles of mothers and fathers as shown by their activities with their children. These characteristics are undoubtedly influenced by the cultural history of Japan. Prior to 1945, the

major role of the Japanese father was to serve as a link between the private life of his family and the public life of society. He was the authority of the family, but was primarily concerned with performing his duties as a member of his business and of the state. Child care was the mother's role. With the legal changes brought about since this period, there has been evidence of more equality between the sexes as substantiated by the observations of the children in this study. This is especially evident in the responsibility for child care now being shared by Japanese fathers.

Both American and Japanese parents were seen by their children as caretakers, helpers during particular difficulties, and sources of support and information. American children perceived their parents as people who were also good friends and playmates, with little distinction made between the father and the mother by either boys or girls. For Japanese children the father was the intellectual authority and disciplinarian; the mother was responsible for general child and house care. That the Japanese father was still an authoritarian figure is indicated by further findings such as: (*a*) Japanese children found it harder than American children to please their fathers (50 per cent/80 per cent); (*b*) American fathers smiled more (82 per cent) than Japanese fathers (40 per cent) and told more jokes (75 per cent/44 per cent); (*c*) Japanese mothers smiled more (60 per cent) than did the fathers (40 per cent).

In general, both Japanese and American children accepted their parents' behavior and activities, but were at the same time capable of evaluating their roles and characteristics. But the cultural themes influenced this evaluation; American children tending to assess parents in relation to their social and financial success, Japanese children tending to use moral and emotional values as the basis of assessment.

E. Summary

In answering a questionnaire, 50 Japanese and 18 American fifth and sixth grade children reported the activities and qualities of their parents in interacting with their children. American children perceived their parents as having very similar roles in child care and as behaving as equals with their children in most activities. Japanese children saw some similarity between parental sex roles in child care, but the father maintained an authoritarian role in the family. There was also a noticeable psychological distance between Japanese parents and children in all activities.

References

1. England, A. O. Cultural milieu and parental identification. *Nerv. Child,* 1947, 6, 301-305.
2. Gardner, L. P. An analysis of children's attitudes toward fathers. *J. Genet. Psychol.,* 1947, 70, 3-28.
3. Kagan, J. Children's perception of parents. *J. Abn. & Soc. Psychol.,* 1956, 53, 257-259.
4. Meltzer, H. Sex difference in children's attitudes to parents. *J. Genet. Psychol.,* 1943, 62, 311-326.

Department of Child Study
Vassar College
Poughkeepsie, New York

The Journal of Genetic Psychology, 1961, **98**, 89-93.

INDIVIDUAL DIFFERENCES IN DISCRIMINATION LEARNING BY CATS*

Department of Psychology, Stanford University

J. M. WARREN[1]

A. PROBLEM

The cats studied in the present experiment were trained on sign differentiated object and positional discrimination problems in order to determine the relative difficulty of these tasks for cats and to permit qualitative comparisons of the results obtained from cats, rats, and monkeys.

Several attempts have been made to classify different sorts of discrimination learning in terms of the processes presumably required for successful performance (Harlow, 1951; Lashley, 1938; Nissen, 1953). There are, however, few data relevant to the question of whether logically distinct types of learning problems do in fact involve independent learning processes. As a test of this possibility, individual differences in performance on the sign-learning problems, on formally simpler kinds of discrimination tasks, and on double alternation were correlated.

B. METHOD

1. *Subjects*

The 21 cats which served in this experiment had previously learned a series of discrimination reversals (Warren, 1960a) and had also been retested under constant conditions on serial reversals of a simple position habit (Cronholm, Warren, & Hara, 1960). Immediately after the present experiment, all of the *S*s learned the double alternation problem under conditions described previously (Stewart and Warren, 1957).

2. *Apparatus*

All testing was conducted in the Wisconsin General Test Apparatus. The stimulus objects were regular geometrical figures (square, cross, trapezoid, etc.) cut from 2 cm. plywood. Large and small objects were 100 and 12.5 sq. cm. in area, respectively. The stimuli were painted black and

* Received in the Editorial Office on May 28, 1959.
[1] This research was supported by Grants M-835 and M-1364 from the National Institute of Mental Health, U.S. Public Health Service.

were presented on a white form-board containing two food wells 12 in. apart.

3. *Procedure*

All of the cats were trained on four sign-differentiated positional (SDP) and four sign-differentiated object (SDO) discriminations. Approximately equal sized groups alternated between SDO and SDP problems in ABBA and BAAB orders, to avoid confounding the comparison of SDO and SDP problems with possible differences in the discriminability of the objects or order of presentation.

The animal's task on the SDP problems was to respond to either the right or left member of a pair of identical objects depending on the size of the stimuli presented on a particular trial. Thus, choice of the left was rewarded when two small triangles were presented, but right was correct when two large triangles appeared on the test tray.

On the SDO problems, the cat was required to select one of a pair of dissimilar figures (e.g., square) when two large objects were presented, and to respond to the other (e.g., semicircle) when small stimuli were presented. The large and small pairs were interchanged irregularly from trial to trial, but each size was presented on 12 trials within each block of 24; there was an additional restriction that the rewarded stimuli appear on the right and left an equal number of times.

Training was continued on each problem until the criterion of 20 correct out of 24 trials was attained, with 48 trials being given each day unless criterion was reached on the first block of 24. The non-correction method was used throughout.

C. Results

The mean number of trials and errors to criterion on the four SDO and four SDP problems was computed for each cat, and then the mean and median of the distribution of the individual means was determined. These averages are included in Table 1. It is readily apparent from inspection of this table that the cats required approximately twice as many trials, made more than twice as many errors, and were more variable in learning the SDO problems than in learning the SDP problems. No statistical test was necessary to determine the significance of the difference between the tasks, since 21 out of 21 cats made more errors on SDO than on SDP problems.

The rank order correlations between individual cats' performance on

TABLE 1
PERFORMANCE BY 21 CATS ON SIGN DIFFERENTIATED OBJECT AND POSITIONAL DISCRIMINATION PROBLEMS

	SDO	SDP
Mean errors	90.9	31.2
Median errors	68.0	30.2
SD	78.5	20.2
Range	12-308	4-66
Mean trials	230.4	93
Median trials	174	96
SD	184.2	48.2
Range	54-760	30-180

the SDO and SDP problems, and other types of discrimination learning and double alternation are presented in Table 2. The tests are listed in their order of presentation, except, of course, that the animals learned the

TABLE 2
RANK ORDER CORRELATIONS BETWEEN ERROR SCORES IN DISCRIMINATION AND DOUBLE ALTERNATION BY 21 CATS

Test	OR	SR	SDO	SDP	DA
Object discrimination	.79**	.67**	.47*	.23	—.08
Object reversal	×	.67**	.56**	.55**	.13
Serial reversal		×	.78**	.34	.23
SDO			×	.81**	.34
SDP				×	.33
Double alternation					×

* Significant at the .05 level of confidence.
** Significant at the .01 level of confidence.

object discrimination and reversal tasks concurrently. Table 2 shows that 8 out of 10 correlations between discrimination tasks are statistically significant. The correlations between SDP learning and performances on object discrimination and serial position reversals are not significant, suggesting that success in SDP problems may not depend on the same constellation of abilities required by the other discrimination tasks.

It is clear, however, that performance on double alternation is not correlated with any kind of discrimination performance. None of the five correlations between alternation and discrimination learning are significant, and one of them is negative.

D. DISCUSSION

The results of this experiment indicate that cats solve SDP problems more rapidly than SDO problems, and that individual differences on dis-

crimination tasks tend to be highly correlated with one another, but not with individual differences in double alternation learning.

These findings have two implications for learning theory. The fact that individual differences in discrimination learning, under superficially quite dissimilar conditions, are positively correlated suggests that a comprehensive theory of discrimination learning could subsume a far wider range of phenomena than current models attempt to handle.

On the other hand, the necessity for caution in generalizing across species is indicated by consideration of the differences observed in discrimination learning by rats, cats, and monkeys. Naive rats learn SDO (conditional) discriminations very slowly (North, Maller, & Hughes, 1958), but solve SDP problems almost as quickly as nonspatial visual discriminations (Bitterman, Tyler & Elam, 1955). Both naive cats and monkeys learn SDP problems much more slowly than nonspatial discriminations (Warren & Baron, 1956; Pribram & Mishkin, 1955), which differentiates their performance from that of rats. Experimentally sophisticated monkeys learn SDO problems more quickly than SDP problems (Warren, 1960b), but experienced cats learn SDP problems more rapidly than SDO problems, indicating a second differentiation between these two species.

E. Summary

A group of 21 cats learned four sign differentiated object (SDO) and four sign differentiated positional (SDP) discrimination problems. Rank order correlations were computed to ascertain the consistency of individual differences on the SDO and SDP problems, on serial reversals of a position habit, on nonspatial discrimination and discrimination reversal tasks, and on double alternation.

1. All of the cats made more errors on the SDO than on the SDP problems.

2. All of the correlations between measures of discrimination performance were positive and 8 of 10 were statistically significant. None of the five correlations between double alternation learning and discrimination learning was statistically significant.

It was concluded that relative success on logically distinct types of discrimination tasks is dependent upon common characteristics of the individual cat, and that the characteristics required for rapid learning of double alternation are not related to those required for efficient discrimination learning.

References

1. Bitterman, M. E., Tyler, D. W., & Elam, C. E. Simultaneous and successive discrimination under identical stimulating conditions. *Amer. J. Psychol.*, 1955, **68**, 237-248.
2. Cronholm, J. N., Warren, J. M., & Hara, K. Distribution of training and reversal learning by cats. *J. Genet. Psychol.*, 1960, **96**, 105-113.
3. Harlow, H. F. Primate learning. *In* Stone, C. P. (*Ed.*), *Comparative Psychology*. New York: Prentice-Hall, 1951.
4. Lashley, K. S. The mechanism of vision: XV. Preliminary studies of the rat's capacity for detail vision. *J. Gen. Psychol.*, 1938, **18**, 123-193.
5. Nissen, H. W. Sensory patterning versus central organization. *J. of Psychol.*, 1953, **36**, 271-287.
6. Northi, A. J., Maller, O., & Hughes, C. Conditional discrimination and stimulus patterning. *J. Comp. & Physiol. Psychol.*, 1958, **51**, 711-715.
7. Pribram, K. H., & Mishkin, M. Simultaneous and successive visual discrimination by monkeys with inferotemporal lesions. *J. Comp. & Physiol. Psychol.*, 1955, **48**, 198-202.
8. Stewart, C. N., & Warren, J. M. Behavior of cats on the double alternation problem. *J. Comp. & Physiol. Psychol.*, 1957, **50**, 26-28.
9. Warren, J. M., & Baron, A. The formation of learning sets by cats. *J. Comp. & Physiol. Psychol.*, 1956, **49**, 227-231.
10. Warren, J. M. Discrimination reversal learning by cats. *J. Genet. Psychol.*, 1960a, **97**, 317-327.
11. ———. Solution of sign-differentiated object and positional discriminations by rhesus monkeys. *J. Genet. Psychol.*, 1960b, **96**, 365-369.

Department of Psychology
The Pennsylvania State University
University Park, Pa.

The Journal of Genetic Psychology, 1961, **98**, 95-111.

GROUP OPERANT BEHAVIOR: AN EXTENSION OF INDIVIDUAL RESEARCH METHODOLOGY TO A REAL-LIFE SITUATION*

Department of Psychology, University of Maine

JOSEPH J. ANTONITIS AND GERALD W. BARNES[1]

A. INTRODUCTION

May the principles of spontaneously emitted or operant behavior which have been derived from animal experiments be applied directly in the understanding and control of human behavior? In reply, the cautious psychologist will reiterate Hilgard's (5) conviction that validating experiments with human subjects in real-life situations are needed before such principles can be accepted as guides for practice. In the time since the lever-pressing method of studying operant behavior was introduced by Skinner (16) in the 1930's, hundreds of studies with rats and other animal subjects have shown the fruitfulness of this method in uncovering fundamental principles underlying operant behavior. While some progress has been made during the past several years in the extension of lever-pressing methodology to the human level to obtain the much needed validation (e.g., 2, 3, 10, 11, 15, 19), none of the available studies can be considered a true real-life test or application of such methodology since all involve the testing of single subjects under controlled laboratory conditions. Could the lever-pressing method be adapted in some real-life situation for the purpose of validating operant behavior principles? This was the question leading to the present research.

The situation which suggested itself to us as promising was the nursery school maintained by our Department of Psychology. We reasoned that if a lever-pressing unit of some kind were introduced into the school room and all the children in the group were allowed to respond to the unit under completely free operant conditions, the resulting records might provide a measure comparable to that obtained when single subjects are tested under controlled laboratory conditions. In short, we believed that if the group of

* Received in the Editorial Office on June 1, 1959.
[1] This research was supported by a grant to the authors from the Wilson Coe Research Fund. The assistance provided by Mrs. Margaret A. Glanville, Mrs. Rose M. Baron, and Mrs. Beverly S. Antonitis is gratefully acknowledged.

children remained relatively stable in constitution and number from one day to the next, a group mean frequency of lever depressions would yield a stable and meaningful measure.

The first problem selected for study was derived from consideration of previous studies of unconditioned lever-pressing behavior in individual rats (4, 13), mice (8), monkeys (20), and preschool children (18). These studies suggested the generality of the principle that responding to a "non-reinforcing" stimulus, namely a movable lever, decreases regularly to a minimum along a negatively accelerated function with successive equal-length exposures to the stimulus. The first problem, then, was to determine whether the response of the group of children to a lever introduced into the school room would follow a similar falling course.

The lever unit was designed so that a study could also be made of the reinforcing effects of onset and termination of dim light. A number of recent studies (e.g., 6, 7, 12) have shown that rats and mice will depress or contact a lever more frequently when such action is followed by a dim light than when it is not. Barnes and Kish (1) have shown, however, that momentary termination of dim light has no apparent reinforcing influence on the lever contacting behavior of mice. Would the group of children similarly show greater response to the lever if lever depression were followed by onset of a dim light than if lever depression were followed by termination of dim light? This was the second problem selected for study. For this second problem, it was deemed advisable to provide two identical lever-pressing units in the school room so that on any experimental day one unit could be used for presentation of light stimulation while the other functioned as a control unit.

Before describing the experimental work, one methodological point must be mentioned. In the usual experiment where scores are obtained from individual subjects, the scores may be subjected to statistical analyses. When the present work was planned, it was clear in advance that abandonment of the usual laboratory procedure of testing subjects singly would mean that conventional statistical treatments of results would not be possible. With two lever-pressing units in the school room, only two scores would be obtained on each experimental day, namely, the totals of lever depressions on the two units. Since the number of children present in school from one day to the next was expected to vary slightly due to occasional illness and absence, it was decided that the group totals of responses on each lever could be adjusted by dividing by the number of children present. With no distri-

butions of scores available, the only possible analyses of the results appeared to be visual comparisons of the magnitudes of such adjusted mean scores. It was decided, therefore, that if the results of the first experiment appeared promising, replication of the experiment would be necessary to lend validity to any judgments. The replication was performed.

B. Method

1. *Subjects*

The nursery school group in Experiment 1 included eight girls and four boys. At the start of the experiment these children ranged in age from 4-4 to 5-5 except for the 2-10 son of the nursery school teacher. Nine had been enrolled in the school on a regular basis for two or more months previously. Of the other three, one boy attended on Mondays and Wednesdays only, another boy attended on Tuesdays and Thursdays only, and a third boy came only on Thursdays. The irregularity of attendance of the children in this group was expected to contribute to the irregularity of the group mean scores on the lever-pressing units from day to day. All of the children, with one exception, were estimated to be of above average intelligence since their parents were members of the University community. The one exceptional youngster was a retarded 4½ year old out-of-town boy who came on Thusdays only.

The group in Experiment 2 included six girls and nine boys in the age range from 3-6 to 4-10 on the first day of observations. These children had attended the school for two to three weeks before the experiment began. Only one child, a girl, had been involved in the previous Experiment 1 group. Two months later one boy, 4-3, and a girl, 4-4, joined the group making a total of 17 regularly participating children during the last three weeks of Experiment 2. In this second group all children were estimated to be of above average intelligence, the mean IQ being near 120.

The daily numbers (*N*s) of children present in the school during Experiment 1 ranged from 5 to 11 with a median of 7; in Experiment 2 the daily *N*s ranged from 8 to 15 with a median of 14.

2. *Apparatus*

Two identical lever-pressing units constructed chiefly of ¾ in. fir plywood were built for placement in the nursery school room. One of the units with essential dimensions indicated is illustrated in Figure 1. The base of each unit was a plywood panel fastened to a 2 in. thick square

wood framework. A 1 in. diameter, hardwood, spring-loaded manipulandum projected 3 in. beyond the front panel at convenient hand height for the youngsters. A downward pressure of 14 oz. through 3/8 in. was required for closure of a snap-action switch within the column. When situated in the school room, a 60 lb. boulder on the base inside the column made the unit quite immovable.

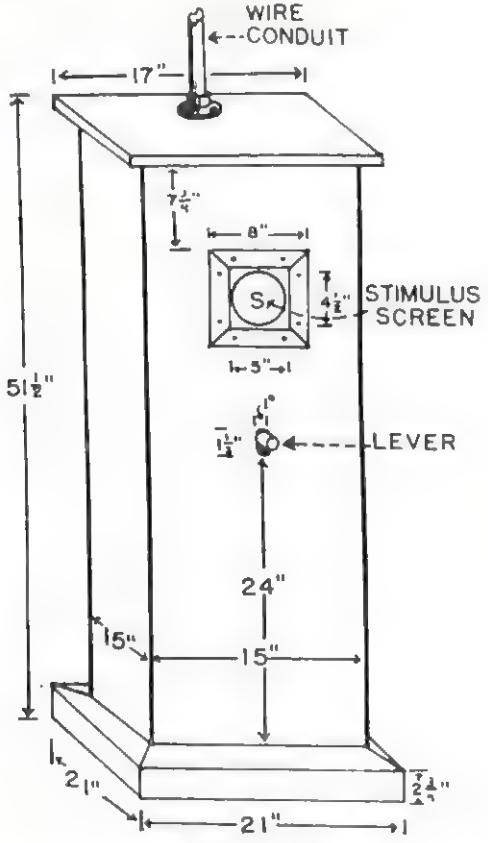


FIGURE 1
SCHEMATIC DRAWING OF THE LEVER-PRESSING UNIT USED IN THE NURSERY SCHOOL SITUATION

The stimulus screen provided by the unit at child's-eye-level was a 5 in. square "sandwich" consisting of a pane of ordinary glass, a sheet of mimeograph paper, and a pane of safety glass in a plain picture frame mounted to cover a 4½ in. diameter round opening in the front panel. Inside the

column behind this round opening a 6 × 6 × 6 in. light box painted white and holding a 7½ w. light bulb was mounted. The black paper cutouts of comic characters used in the final phase of Experiment 2 only were placed behind the mimeograph paper between the panes of glass and were invisible when the light behind the screen was off; when the light was on, the figures appeared in clear, sharp outline.

Wires leading to the switches and lamps entered the columns via ½ in. diameter conduits which extended above the tops of the units to the ceiling of the room. These wires were led along the ceiling to an adjacent sound-proof room where the recording and stimulus-control equipment was located.

The units were placed 45 in. apart with a table between them against a long wall near one end of the 20 × 45 ft. school room and faced floor space normally used by the children for block-building and other forms of creative play. The units were painted a light blue-gray, with the levers and frames of the stimulus screens painted flat black. These colors were chosen for effective contrast with the pale yellow walls of the room.

Gerbrands Model C cumulative recorders and electric counters were used for recording of lever depressions. The control circuitry was conventional.

3. *Procedure*

A brief description of the nursery school routine seems necessary here to indicate the degree of control which the nursery situation provided over the behavior of the children. Since the group in Experiment 1 was small, the teacher felt that it was undesirable to follow a regular routine. Generally, the children were allowed free play from opening time, 8:50, to about 9:30. Group activities occurred from 9:30 to about 10:00; then, following juice and crackers and a brief rest, on pleasant days the children spent the rest of the morning in an outdoor playground. On unpleasant days, more group activities were spontaneously organized or moving pictures shown from 10:30 to 11:50 when the school closed. The teacher was occasionally assisted by four students enrolled in a child study course.

During the following fall semester when the Experiment 2 data were collected, the routine arranged by the new teacher provided the experimentally more desirable day-to-day uniformity of conditions. Although the teacher and her small daughter often arrived at the school at about 8:00, the school did not open officially until 8:50. Most children were present in the school by 8:55, and free play was allowed until 9:30. Following health inspection, free play continued until 10:05. Fifteen minutes were then allowed for juice

and crackers, followed by a 15 minute rest. From 10:35 to 11:05 creative activities were scheduled. On pleasant days the children went outside at about 11:00, and on unpleasant days stayed in the room engaged in creative play until about 11:50. The teacher was regularly assisted by one or more child study students daily during the fall.

During both experiments, the lever units were "turned on" before the first child arrived and "turned off" after the last child left the school.

The four phases of Experiment 1 were as follows:

a. Operant level determinations (*Days 1-10*). The units were wired so that cumulative records and counts of spontaneous, unconditioned lever depressions would be obtained. The only perceptible consequences of lever depressions were "clicks" of the snap-action switches within the units, thumps of the levers against their rubber bumpers, and kinesthetic sensations arising from lever manipulations. The teacher and student assistants were instructed not to direct the attention of the children either toward or away from the units or to organize any activities involving the units. If the children asked what the units were, the adults in the school simply replied that they were toys. Observations of the children's behavior toward the units were made from time to time by the experimenters since the teacher did not turn out to be a reliable source of information.

b. Reinforcing effect of "Light On" (*Days 11-16*). On each of these days one unit was connected so that the light behind the stimulus screen appeared as a round spot each time the lever was depressed. Light duration was, as in the experiment by Kish (7) with mice, conterminous with lever depression. The light-providing unit was selected at random on each day with the restriction that both units would act as experimental units an equal number of days so any preference for one unit would be cancelled out. On each of these days the control unit provided no light onset.

c. Reinforcing effect of "Light Off" (*Days 17-21*). On each day of this phase one unit was connected so that the light behind the stimulus screen went off conterminously with lever depression. A similar spot of light displayed on the screen of the control unit could not be turned off, in analogy with the control condition of Barnes and Kish (1) in an experiment with mice. Again, the experimental unit on any day was determined at random as in the preceding phase.

d. "Light On" vs. "Light Off" (*Days 22-30*). This series of observations was designed in an attempt to determine whether onset or termination of light had greater reinforcing potential. On each day, one of the two units,

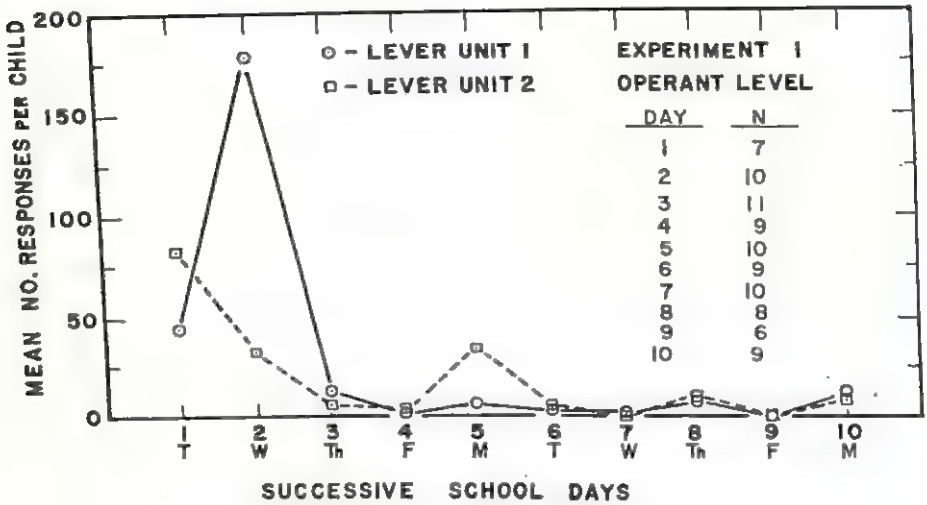
chosen at random as before, provided that the light on the stimulus screen would appear when the lever was depressed; the other unit provided that the light displayed would disappear for as long as the lever was depressed.

As confirmation of Experiment 1 observations, this series of observations with only slight modification was repeated and extended with the second, larger group of children during the following fall semester. A reliable full-time observer was also stationed in the school room to collect qualitative data on the nature of the responses, verbalizations, and social interactions which the children manifested while reacting to the units. The observer's records also provided a reliable count of the number of children responding to the units each day.

In Experiment 2 the operant level phase was extended to 11 days, the extra day being added to insure that any spontaneous recovery due to an intervening three-day weekend had been dissipated. The "Light On" and "Light Off" phases in Experiment 2 included the same numbers of days as in Experiment 1. Although it was originally planned to extend the fourth or "Light On" vs. "Light Off" phase of Experiment 2 for as many days as in Experiment 1, observations were made for five days only since both the objective data and the observer's reports showed that the children were satiated for these reinforcers. Since the question whether "Light On" or "Light Off" was the more reinforcing had still not been answered clearly, decision was made to continue observations using simple pictorial stimuli on the unit screens with the hope that these stimuli would increase responding to a reasonable level, work by Long (11) having shown that pictures could act as reinforcers with children. The reasoning was that if the two units displayed identical pictorial stimuli, lever pressing rates on both would increase but such reinforcing value as the pictures had could be considered constant; hence, any difference in the reinforcing values of "Light On" and "Light Off" would be apparent. These pictorial stimuli, prepared by a competent art student, were black paper cutouts of comic characters selected with the aim of being appealing to the youngsters. Except for the complete cutout of Jack O'Lantern, cutouts depicted only the faces with most characteristic expressions and the shoulders of the characters. This final phase of Experiment 2 was carried out without the help of an observer since funds were exhausted, and occupied Days 28 through 37.

C. Results and Discussion

Figure 2 presents the operant level data obtained in the initial phases of Experiments 1 and 2. The tables included within the panels of this and



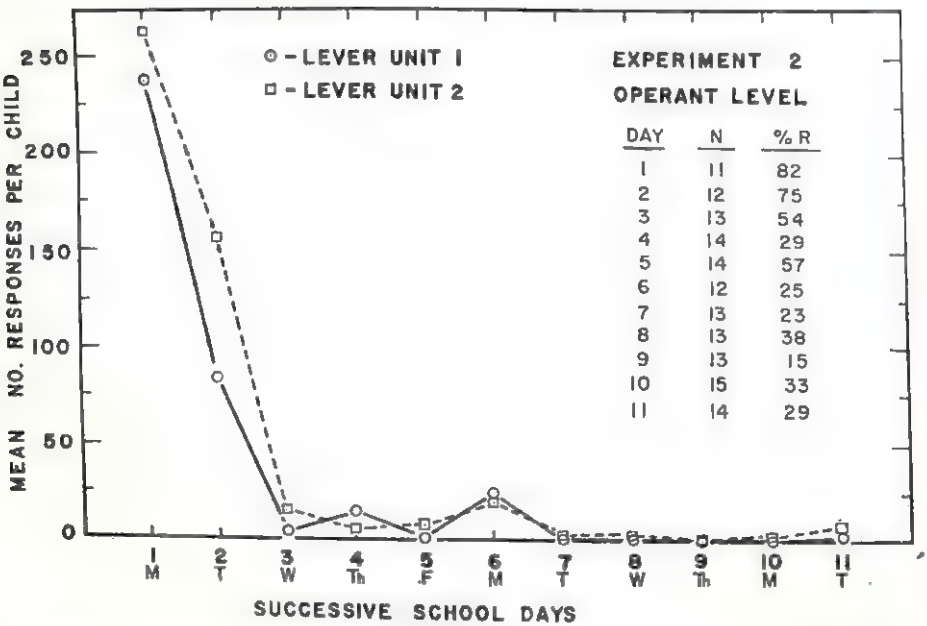


FIGURE 2

GROUP OPERANT LEVEL CURVES ON THE TWO LEVER-PRESSING UNITS FOR EXPERIMENT 1 (UPPER PANEL) AND EXPERIMENT 2 (LOWER PANEL)

Tabular insets in both panels show the number of children present in the school on each day under *N*. The *%R* column in the Experiment 2 table gives the per cent of children observed as responding to one or both units on each day. The letters below the numbers of successive school days indicate the days of the week.

the figures which follow show the number of children present in the school on each day, and, in the instance of Experiment 2, the per cent of children present observed as responding with one or more lever depressions on either unit. Except for the one prominent irregularity in the Experiment 1 data, the obtained group operant level curves generally resemble the group mean day-to-day unconditioned response curves which have been reported for rats (13), mice (8), and preschool children (18). The principle earlier discussed that responding to a "non-reinforcing" stimulus decreases regularly to a minimum along a negatively accelerated function is clearly reflected in these curves obtained in an experimentally uncontrolled real-life test situation.

In the Experiment 1 data in Figure 2, the sharp increase in number of responses on Unit 1 from Day 1 to Day 2 is due to the fact that the boy who came on Monday and Wednesday only, upon seeing the "new toys" for the first time on Wednesday, adopted Unit 1 as his own and spent the larger part of his free time standing beside the unit, moving the lever, and preventing other children from approaching. The apparent spontaneous recovery effect on Unit 1 on Day 5, following a two-day weekend, was also produced by this boy. The "bumps" in the Experiment 2 curves on Day 6, however, do appear to reflect true spontaneous recovery of the response following the first two-day weekend. No noticeable spontaneous recovery appears to follow the second weekend breaks in either experiment. It is of interest to note that the animal research literature as yet appears to contain no systematic investigation of spontaneous recovery of unconditioned operant behavior.

The $\%R$ data for Experiment 2 in Figure 2 show a general decrease in the per cent of children responding to either unit with successive days. It will be noted that not all children responded on Day 1. The observer's record shows that the units were appropriated largely by active boys and two little girls just didn't get a chance to approach the units during available free time on the first day.

The record of verbalizations by the children in the Experiment 2 group indicates that a wide variety of generalizing tendencies accompanied the lever responses. In an over-all way the units could not possibly resemble specific objects or toys with which these very young children were familiar. Yet, one boy said, "This is a horse," and tried to mount the lever. Another said, "I'll make this sing." Still another, "This is a gun and you put the bullets in back here." A few more samples: "This is a cash register." "Car-

toonie!" "Cuckoo, cuckoo." "One, two, three, blast off!" Such verbalizations while pressing the levers decreased with continued days, and agreement was apparently reached in the Experiment 2 group that the units were "picture-taking machines" or TV sets that did not work.

The record of social interactions among the children included fights, some cooperation, and rather consistent associative imitative behavior. The latter was particularly notable from Day 4 on in the cumulative records of both experiments, the general rule being that when one child went to one unit and began pressing, another child would go to the other unit, and when one left, the other would leave also. In this and succeeding phases of the experiments, observations very definitely established that when one child responded to one of the units, the perception of this by other children tended to motivate them to do likewise.

Figure 3 presents the data for the "Light On," "Light Off," and "Light On" vs. "Light Off" phases of the two experiments. In Experiment 1 the fact that one unit would now produce a spot of light on the stimulus screen was discovered almost immediately on Day 11, and the children responded to that unit throughout the morning. The mean number of responses rose from 12.7 per child on the preceding final operant level day on this unit to 119.6 per child on the first "Light On" day. In Experiment 2, however, when the "Light On" feature was made available on Day 12, three children pressed the lever of the "No Light" unit 30 times and one child while passing the "Light On" unit pressed the lever once but did not see the flash of light. On Day 13 a boy finally discovered the "Light On" feature at 11:45 and shouted the news to the other children who were dressing in preparation for going home. Immediately all the children rushed to the units. The observer's notes read: "All the children are at the units. Doug and Johnny are fighting vigorously. Johnny was just bitten. The teacher is reprimanding Johnny who says, 'I was here first—he tried to take it away from me.' Susie comes to her brother's defense by hitting John. Other children bombard him . . . ." In the succeeding 16 minutes the children pressed the "Light On" lever 542 times and the "No Light" lever 413 times.

Figure 3 shows that the "Light On" effect was quite powerful and held up rather well for several days. The low values on both units on Day 13 of Experiment 1 are due to the fact that an energetic student assistant assumed control of the group at 9:00 and arranged a series of novel and interesting activities which occupied the children for the entire morning. The low and approximately equal scores for Day 14 of Experiment 1 are accounted for

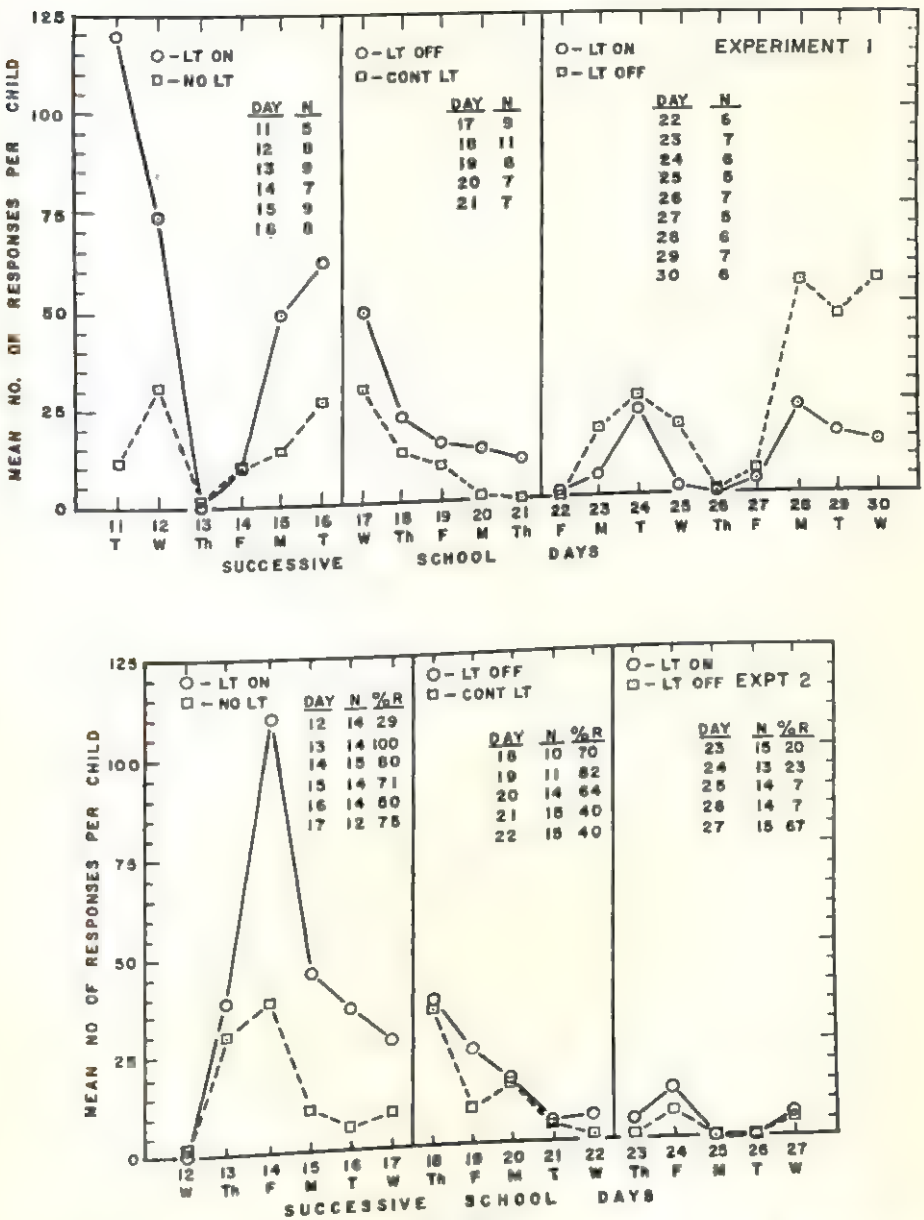


FIGURE 3

MEAN NUMBER OF RESPONSES PER DAY PER CHILD IN THE THREE EXPERIMENTAL PHASES "LIGHT ON," "LIGHT OFF," AND "LIGHT ON" VS. "LIGHT OFF" FOR EXPERIMENT 1 (UPPER PANEL) AND EXPERIMENT 2 (LOWER PANEL)

by the fact that the children went on a field trip and spent only about 35 minutes in the room. On the following Monday the school routine returned to normal and lever pressings increased. The Experiment 2 "Light On" data, obtained under more regular day-to-day conditions, show the expected satiation effect. In both experiments the data also show quite clearly that responding on the "No Light" or control unit has risen above the level of the preceding operant level phase.

That "Light Off" exercises a very fair reinforcing effect is apparent in the center portions of Figure 3. This is in opposition to the recent report of Barnes and Kish (1) that termination of light exercised no reinforcing influence on lever-contact behavior in mice. The need for studies like the present one before applying animal research results to children is underlined by this difference. The difference, of course, may be due to the fact that the stimulus change for the mice was from dim light to total darkness. Whether the children would have been reinforced if pressing the lever plunged the room into total darkness is a question that cannot be answered. The more reliable data of Experiment 2 show that the introduction of "Light Off" reinforcement raised the response rates on both the "Light Off" unit and the "Continuous Light" control unit well above the mean of the "Light On" unit on the last day of the preceding phase. In five out of five comparisons in both experiments the mean number of responses per child on the "Light Off" unit is larger than the mean number of responses per child on the "Continuous Light" control unit. In both experiments rather regular satiation curves for the "Light Off" reinforcement were generated by the two groups of children.

The $\%R$ data in the "Light On" and "Light Off" tables in the lower panel of Figure 3 suggest that as satiation for these reinforcers occurred, the percentage of children in the Experiment 2 group showing response to the units decreased. These decreases, however, are not as clear-cut as that which occurred during the preceding operant level phase (table in lower panel of Figure 2). Examination of the cumulative response records and qualitative observations of the children's behavior showed that under both reinforcing conditions individual children tended to respond in bursts of lever depressions, the numbers of responses in bursts decreasing from day to day. Further, the children often responded with such bursts without even looking at the stimulus screens. And, again, as during the operant level phases, the general rule was that when one child responded to one unit,

this tended to motivate some other child to respond to the other non-reinforcing unit.

Is "Light On" or "Light Off" more reinforcing for children? We hoped that the procedure of the fourth phase would provide an answer, but the objective data from the two experiments are conflicting. Examination of the measures plotted in the extreme right portions of the two Figure 3 panels shows that in Experiment 1 "Light Off" appears to be the more reinforcing effect in 7 of 9 comparisons with "Light On," but in Experiment 2 the "Light On" effect appears to have a slight edge over "Light Off" in 3 of 5 comparisons. This inconsistency between the results of Experiment 2 and Experiment 1 during this phase plus the fact that Experiment 2 response rates were nearly at the zero level led to the decision to terminate this phase of Experiment 2 after Day 27.

Is there any difference in the reinforcing effectiveness of "Light On" and "Light Off" when pictorial stimuli are added to the stimulus screens? Figure 4 presents the data obtained during the fifth and final phase of

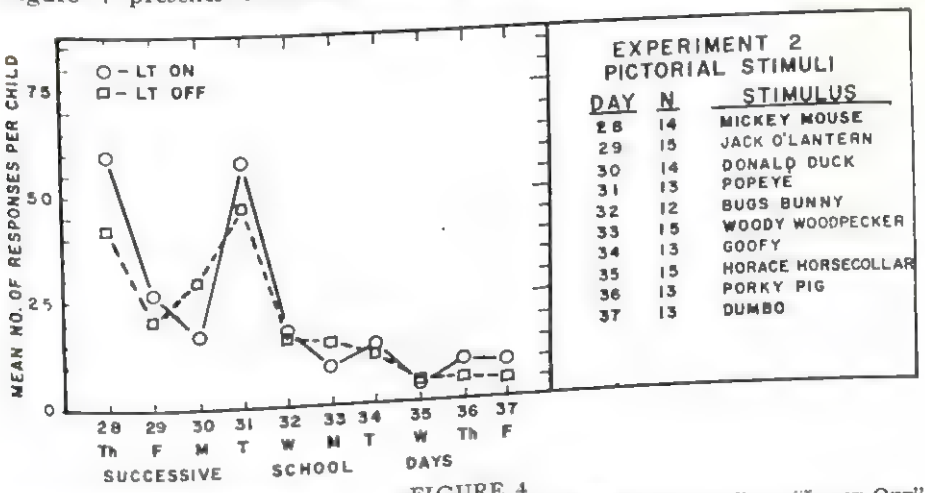


FIGURE 4

MEAN NUMBER OF RESPONSES PER DAY PER CHILD IN THE "LIGHT ON" VS. "LIGHT OFF" PICTORIAL STIMULUS PHASE OF EXPERIMENT 2

The table at the right shows the number (N) of children present each day and the comic character used as the pictorial stimulus.

Experiment 2 where, as in the preceding phase, one of the two lever-pressing units on each day provided "Light On" reinforcement, and the other, "Light Off" reinforcement. The data in Figure 4 show that on 7 of the 10 days of this phase greater mean numbers of responses per child were made on the

"Light On" unit. The over-all 10 day means of the daily means were 23.0 and 20.0 for the "Light On" and "Light Off" units respectively. This difference is not large and since its statistical significance cannot be assessed, the tentative conclusion must be that the data suggest "Light On" is probably a somewhat more effective reinforcing consequence than "Light Off" when a pictorial stimulus is used. Qualitative observations suggest further that the children in the room were initially more greatly attracted to the "Light Off" unit with its illuminated screen but found pressing its lever was less reinforcing than pressing the lever of the "Light On" unit. The former unit made the attractive stimulus disappear while the latter unit provided for appearance of the attractive stimulus.

The data in Figure 4 also show clearly that the addition of the pictorial stimuli caused response rates on both units to rise on Day 28 to levels well above those of the preceding phase of Experiment 2. Even though the pictorial stimuli were changed every day, a clear satiation effect over the 10 day period is apparent, the regularity of the curves marred only by the sharp increase in rates on Day 31 when Popeye was displayed on the screens. The high response to Popeye appears to be accounted for by the fact that at the time of this experiment "Popeye Theater" was appearing nightly on a local television station, and for the majority of the children Popeye was a familiar and reinforcing character. It would be interesting to know if Dumbo, who was recognized only by one or two of the children according to the teacher, would have exercised a greater reinforcing influence if he had come first in the series instead of last. In any event, the results seem to show that when pictorial stimuli belong to a common class, stimuli which are presented earlier have greater reinforcing potential than stimuli which are presented later. Further systematic investigation is necessary to confirm this suggested hypothesis.

Examination of the data obtained during this final phase of Experiment 2 and, as already mentioned, during the "Light On" and "Light Off" phases of both experiments shows that when one child was pressing the lever of one unit, another child often tended to come over and press the lever of the other unit. This also occurred during the initial operant level phases. The simplest explanation of this phenomenon is, perhaps, that which has been offered by Skinner (17, p. 311) to explain imitative behavior in groups. The children were manifesting a learned general tendency to behave as others behave, i.e., to imitate since in their previous experiences they had found that doing like others do was likely to be reinforcing. Lewis and Duncan (9)

have demonstrated recently that the perception of another person procuring reinforcement acts to motivate imitative behavior in the perceiver. During the operant level or "Non-reinforcing" phases of the two experiments, if the children regarded the units as toys, and apparently they did, the perception of one child playing with one of the toys motivated one or more other children to do likewise with the same toy or with the second identical toy. Playing with a toy is clearly reinforcing for children. During the "Light On" and "Light Off" phases of the two experiments, when one of the two units did not provide the obvious reinforcing consequence, any child in the room could perceive that the child at the experimental unit was procuring "Light On" or "Light Off" reinforcement as well as such reinforcement as is associated with toy playing. This perception of another child procuring reinforcement, which may be called vicarious reinforcement, motivated the perceiving child to respond similarly to the other available non-reinforcing unit. Of course the perceiving child often tended to displace the child at the reinforcing unit, but, failing this, went to the non-reinforcing one. The continued perception of the fact that the child at the experimental unit was procuring reinforcement may well have maintained the high levels of responding which were observed on the control unit. This analysis holds that vicarious reinforcement is a form of secondary reinforcement, and is compatible with the theory developed by Seward (14) that secondary reinforcement exercises a motivational function as well as a reinforcing one.

Can the results of the present research be regarded as valid? Considering the fact that the method used does not provide for experimental controls and the fact that the quantitative measures obtained do not appear to lend themselves legitimately to conventional statistical assessment, some readers may look with doubt upon the results we have reported. We can only point to the fact that essentially the same results were obtained in observations repeated on two independent groups and that, further, these observations with the possible exception of the finding that "Light Off" is reinforcing yielded results in line with expectations based on the results of previously reported laboratory experiments. We could, of course, replicate this work with additional independent groups of children to obtain the necessary numbers of scores for t tests or other statistical treatments, but since we have convenient access to only one nursery school, this would require several more years. We suggest that when this method is used, if repeated observations on a single group are in line with the results of individual research, the observations be accepted as having minimum validity. When observations are not in

accord with expectations based on individual research or when a novel hypothesis is tested, we suggest that replication with a second independent group constitute minimum validation.

In conclusion, we feel that the method developed which treats the group as an individual holds considerable future promise not only for the purpose of real-life validation of rat research but also for the testing of hypotheses which cannot be tested with animals. For example, research has been planned to investigate the influence of automatically presented oral statements on the behavior of the next available group of children.

D. Summary

The lever-pressing method of studying individual operant behavior was adapted for the study of the free operant behavior of groups of preschool children in the experimentally uncontrolled real-life environment of a nursery school. Two independent, fairly stable groups of children yielded declining operant level curves remarkably similar to previously reported day-to-day mean curves based on laboratory tests of single subjects. The data obtained also showed that subject-controlled onset or termination of a spot of dim light exercised a powerful reinforcing effect on the lever-pressing behavior of the groups, the effect diminishing with successive days. When pictorial stimuli were added, the results suggested that onset of light was more reinforcing than termination. Associative imitative behavior observed consistently in both groups of children was accounted for as reflecting a learned tendency to behave as others do since this has been reinforced in the past.

References

1. Barnes, G. W., & Kish, G. B. Behavioral effects of the cessation of weak light energy. *Amer. Psychol.*, 1957, **12**, 411.
2. Bijou, S. W. Patterns of reinforcement and resistance to extinction in young children. *Child Devel.*, 1957, **28**, 47-54.
3. Fattu, N., Auble, D., & Mech, E. V. Partial reinforcement in a bar-pressing situation with preschool children. *J. Genet. Psychol.*, 1955, **87**, 251-255.
4. Hefferline, R. F. An experimental study of avoidance. *Genet. Psychol. Monog.*, 1950, **42**, 231-334.
5. Hilgard, E. R. Theories of Learning. New York: Appleton-Century-Crofts, 1956.
6. Hurwitz, H. M. B. Conditioned responses in rats reinforced by light. *Brit. J. Anim. Behav.*, 1956, **4**, 31-33.
7. Kish, G. B. Learning when the onset of illumination is used as reinforcing stimulus. *J. Comp. & Physiol. Psychol.*, 1955, **48**, 261-264.
8. Kish, G. B., & Antonitis, J. J. Unconditioned operant behavior in two homozygous strains of mice. *J. Genet. Psychol.*, 1956, **88**, 121-129.

9. LEWIS, D. J., & DUNCAN, C. P. Vicarious experience and partial reinforcement. *J. Abn. & Soc. Psychol.*, 1958, **57**, 321-326.
10. LINDSLEY, O. R. Operant conditioning methods applied to research in chronic schizophrenia. *Psychiat. Res. Rep.*, 1956, **5**, 118-139.
11. LONG, E. R. An investigation of operant conditioning techniques for children. (Privately issued terminal progress report of Small Grant No. M-2007, University of North Carolina, 1958.)
12. MARX, M. H., HENDERSON, R. L., & ROBERTS, C. L. Positive reinforcement of the bar-pressing response by a light stimulus following dark operant pretests with no aftereffect. *J. Comp. & Physiol. Psychol.*, 1955, **78**, 73-75.
13. SCHOENFELD, W. N., ANTONITIS, J. J., AND BERSH, P. J. Unconditioned response rate of the white rat in a bar-pressing apparatus. *J. Comp. & Physiol. Psychol.*, 1950, **43**, 41-48.
14. SEWARD, J. P. Secondary reinforcement as tertiary motivation: a revision of Hull's revision. *Psychol. Rev.*, 1950, **57**, 362-374.
15. SIEGEL, P. S., & FOSHEE, J. G. The law of primary reinforcement in children. *J. Exper. Psychol.*, 1953, **45**, 12-14.
16. SKINNER, B. F. On the rate of formation of a conditioned reflex. *J. Gen. Psychol.*, 1932, **7**, 274-285.
17. ———. Science and Human Behavior. New York: Macmillan, 1953.
18. SKINNER, W. D. The lever-pressing behavior of the preschool child under regular and intermittent schedules of reinforcement. (Unpublished M.A. thesis, Univ. Maine, 1952.)
19. SPIKER, C. C. The stimulus generalization gradient as a function of the intensity of stimulus lights. *Child Devel.*, 1956, **27**, 85-98.
20. URMER, A. H. Spontaneous lever pressing in monkeys. *Psychol. Rep.*, 1957, **3**, 361-362.

Department of Psychology
University of Maine
Orono, Maine

The Journal of Genetic Psychology, 1961, 98, 113-118.

CONDITIONAL DISCRIMINATION IN RATS*

Department of Psychology, Southern Methodist University

ALVIN J. NORTH AND PATRICIA LANG

A. PROBLEM

North, Maller, and Hughes (3) have confirmed Lashley's (2) finding that albino rats are capable of solving conditional discrimination problems. In both studies the rats learned, for example, to choose an erect triangle in preference to an inverted one when both were on black backgrounds, but to reverse the sense of this reaction, i.e., to choose the inverted triangle when the two figures appeared on striated backgrounds. After alternately learning each of these problems four times, the two problems were alternated from trial to trial, and the animals continued to respond appropriately.

The main purpose of the present study was to determine whether albino rats are capable of solving conditional discrimination problems when the stimulus elements appear to form "weak gestalts" rather than "strong gestalts." Whereas to the human observer a triangle and its background appear readily to form a figure-ground relationship, the spatially discrete plaques and gates (see Figure 1) used in the present study appear to be much less well integrated as stimulus patterns. Another purpose was to determine whether the effective stimulus, in the event conditional discrimination became mastered, was each gate-plaque compound or a configuration (the total set of gates and plaques present on trial).

B. METHOD

1. *Subjects*

The *S*s were 12 experimentally naive male albino rats of the Wistar strain. They were about 70 days old when the experiment began.

2. *Apparatus*

The apparatus, which has been described more fully elsewhere (1), was a modified Yerkes discrimination box, painted gray throughout. After leaving a starting compartment, the rat was confronted with a pair of stimulus compounds (see Figure 1) separated by a partition. Each compound con-

* Received in the Editorial Office on June 1, 1959.

sisted of an aluminum gate hinged at the top and a floor plaque. Each plaque had mounted on it a pair of longitudinal or transverse gray-painted bars. The gates, either of which could be locked, were painted glossy white or black. In the goal compartment was a jar lid containing a wet mash of ground Purina Laboratory Chow.

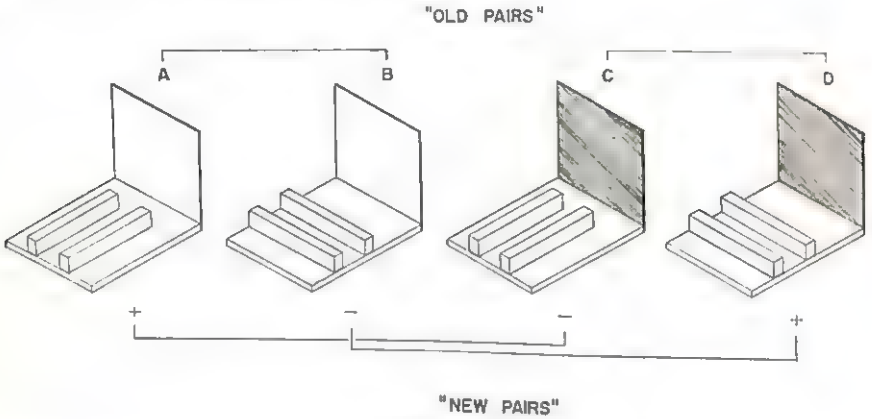


FIGURE 1
STIMULI USED DURING TRAINING AND TEST PHASES: EACH GATE-PLAQUE COMBINATION WAS CONSISTENTLY POSITIVE OR NEGATIVE

3. *Procedure*

After being placed on a schedule of once-daily feeding (with about a 22-hour hunger drive), the rats were given 18 pretraining trials. During this phase gray plaques and gates were used, the frequency of right and left choices was equated, and self-correction of errors was permitted. In self-correction *S* remains in the apparatus after making an error (defined as touching the locked gate) until he has passed through the unlocked gate. Self-correction was permitted throughout the experiment, so that a rat was rewarded on every trial (five seconds of eating).

The experiment proper was divided into a training and a test phase. Training was given on two component problems. One problem was to discriminate the *A* and *B* stimuli of Figure 1, while the other problem was to discriminate the *C* and *D* stimuli of the same figure. The reinforcement conditions in the two problems were such that only gate-plaque compounds were consistently positive or negative, whereas stimulus elements were not consistently so. There were 20 (later, 30) trials daily, with trials being spaced at least five minutes apart. Stimuli were presented in a restricted

random order with the usual precautions to avoid positional biases, runs, etc. It was planned originally to have each rat learn the two problems (to a criterion of 10 successive correct responses) in alternation until each had been learned and relearned four times, a total of eight tasks. Three animals, however, had completed seven or fewer problems by 1100 trials; they were dropped from the experiment. The other nine rats, which required from 610 to 970 trials for the first eight tasks, obviously needed further training. Two schemes were followed in this regard. Four rats (Group ALT) were given 200 additional trials (plus enough to complete the last task) with alternation of problems as before. These rats completed from six to 12 additional problems and had an average of 88 per cent correct responses during this period. The other five rats (Group CON) were shifted to a concurrent schedule for 200 trials in which the two problems were alternated from trial to trial in a restricted random order. Their average per cent of correct responses during this period was 84 per cent, which was comparable to that of Group ALT. The purpose in shifting some animals to a concurrent schedule was the hope that shifting problems frequently would somehow facilitate conditional discrimination. Care was taken to match the two groups on the basis of errors in the first eight tasks: Group ALT had a mean of 273.3 errors (SD = 63.3) while Group CON had a mean of 281.8 errors (SD = 48.3).

As soon as a rat had completed training, he was given a 48-trial test for type of stimulus patterning—compound or configural. The stimuli used are shown in Figure 1. Four stimulus arrangements (A vs. B, B vs. A, C vs. D, and D vs. C) had been experienced during training, and therefore may be called "old" pairs. Four other stimulus arrangements (A vs. C, C vs. A, B vs. D, and D vs. B) were composed of the positive member of one training problem and the negative member of the other problem—an arrangement not previously experienced as such. Hence these latter arrangements may be called "new" pairs. In each block of eight trials each arrangement occurred once, and runs of more than three positive responses on a given side were not permitted. The question at issue was whether during training response tendencies had been established primarily to each of the four stimulus compounds (A, B, C, and D) or to each of the four stimulus configurations (AB, BA, CD, and DC). The logic was as follows: If, at the end of training, the effective cues were compounds, then a rat should perform as well on the new pairs as on the old ones. On the other hand, if only configural cues were effective, then a rat should perform at

no better than a chance level on the new pairs. Intermediate results would indicate that both types of cues were being utilized.

C. Results and Discussion

In the following section the results for the nine rats that completed the experiment are presented. Table 1 shows trials and errors for these nine rats in Tasks 1-8 inclusive, and for Group ALT only in Tasks 9-14.

TABLE 1
Trials and Errors in Training Phase*

Task No.	Mean trials to criterion	Mean errors to criterion	No. of *Ss* making initial error
1	97.8	40.2	3
2	126.7	56.3	8
3	177.8	79.9	7
4	98.9	33.3	6
5	93.3	34.1	5
6	57.8	15.1	3
7	58.9	12.8	5
8	36.7	6.2	2
9	30.3	4.2	0
10	42.5	8.2	2
11	27.5	3.3	1
12	32.5	3.3	0
13	22.5	2.2	0
14	20.0	1.0	0

* The statistics for Tasks 1-8 inclusive are based on the data of the nine rats that completed the experiment while the statistics for Tasks 9-14 are based on the data of the four rats (Group ALT) that continued to learn the two problems alternately for 200 additional trials.

It is obvious from the table that there was marked improvement in performance after a period of maximal interference in the region of the second and third tasks. The data also show that in early tasks animals tended not to shift their response on the *first* trial of each task; that is, they tended to continue to respond to the bar element that had been positive in the preceding problem. But in later problems the rats tended to shift immediately to the correct bar element when the problem was changed, which is indicative of conditional discrimination.

The data for individual rats during the test phase are shown in Table 2. The overall performance of the animals is clearly indicative of achievement of conditional discrimination, although there were considerable individual differences in level of mastery. Five *Ss* had over 90 per cent correct responses in the 48 test trials. These findings indicate that albino rats are able to

master conditional discrimination problems even though the stimulus patterns consist of spatially discrete elements, i.e., so-called "weak gestalts." Such problems, however, are quite difficult.

TABLE 2
ERRORS ON OLD AND NEW STIMULUS ARRANGEMENTS IN THE TEST PHASE

	Group ALT				Group CON		
Ss	Old pairs	New pairs	Both	*Ss*	Old pairs	New pairs	Both
# 3	0	0	0	# 1	8	9	17
# 8	1	1	2	# 2	0	3	3
#10	1	2	3	# 5	4	7	11
#11	2	2	4	# 6	5	2	7
				# 9	2	3	5
Means	1.00	1.25	2.25		3.80	4.80	8.60
Per cent correct	96	95	95		84	80	82

An important comparison is that for errors with old vs. new stimulus pairs. Of the nine rats, five made more errors on the new pairs than on the old. One made more on the old, and three had no difference. A *t* test of the hypothesis of a mean difference of zero errors as between old and new pairs yield a *t* ratio of 1.1, which is not significant. The mean per cent of correct responses on old and new pairs was high and about equivalent (91 per cent and 87 per cent respectively). Incidentally, there was no evidence of further learning with respect to the new pairs when the mean per cent of errors on such pairs in the first 24 trials was compared with that in the last 24 (10 per cent vs. 16 per cent). On the assumption that performance would have broken down on new pairs if the effective cues had been the particular configurations of stimuli which had been present during training, these results indicate that primarily "compound" rather than "configural" patterns were the effective cues. These results are in agreement with those obtained by North, Maller, and Hughes (3) in a similar test.

Comparing Groups ALT and CON with respect to total errors in the test phase, there was a small, but significant, difference in favor of Group ALT. In order to make this test, error scores were subjected to the square root transformation so as to equate variances and reduce skewness. The *t* ratio was 2.5, which for 7 *df* is significant at the 5 per cent level. Inspection of Table 2 discloses that the direction of the difference in errors was in favor of Group ALT for both old and new pairs. It appears, therefore, that alternate training alone may have been slightly more effective

than alternate and concurrent training together. The outcome, of course, might have been different if one group had been given concurrent training from the outset.

The perceptual status of stimulus elements and compounds in conditioned discrimination is an interesting problem. One possibility is that as perceptual events elements and compounds remain invariant during the course of training—all that changes is the relative strength of associations with these different orders of stimuli. According to this analysis, response tendencies to the several element cues would tend to become balanced in strength whereas the response tendencies to the several compound cues would gradually become differential as a result of the reinforcement conditions, but without any change in the perception of the compounds themselves. A second possibility is that compounds become perceptually dominant over element percepts in conditional discrimination training. As a result element cues become largely nonfunctional, while compounds effectively determine response. Further study is needed to discriminate among these alternatives.

D. Summary

Albino rats were trained on a conditional discrimination problem in which each of four gate-plaque compounds was consistently positive or negative, while the several stimulus elements were not so. Nine of 12 rats mastered conditional discrimination to varying levels of proficiency. A test for type of stimulus patterning showed that the effective stimuli were the several gate-plaque compounds rather than the configuration of all gate and plaque stimuli present on a trial. A training schedule in which component problems were alternated proved to be somewhat more effective than a sequence of alternating and concurrent schedules.

References

1. Hughes, C. L., & North, A. J. Effect of introducing a partial correlation between a critical cue and a previously irrelevant cue. *J. Comp. & Physiol. Psychol.*, 1959, **52**, 126-128.
2. Lashley, K. S. Conditional reactions in the rat. *J. of Psychol.*, 1938, **6**, 311-324.
3. North, A. J., Maller, O., & Hughes, C. L. Conditional discrimination and stimulus patterning. *J. Comp. & Physiol. Psychol.*, 1958, **51**, 711-715.

Department of Psychology
Southern Methodist University
Dallas 5, Texas

The Journal of Genetic Psychology, 1961, 98, 119-126.

CALIFORNIA TEST OF MENTAL MATURITY b WEIGHTS FOR PREDICTING A COMPOSITE SCORE ON THE IOWA TESTS OF EDUCATIONAL DEVELOPMENT*

Phoenix Union High Schools and Phoenix College System, Arizona

RUSSELL N. CASSEL AND EDWARD J. STANCIK

A. PROBLEM

This study was concerned with developing *b* weights for the language and non-language raw scores on the California Test of Mental Maturity (CTMM) that would serve as an effective basis for computing expected achievement indexes (XA's) with significant status validity in relation to a factorially pure composite on the Iowa Tests of Educational Development (ITED). It as a portion of a larger study that has the general objective of improving the regular guidance testing battery for entering 9th grade students in the seven high schools (representing approximately one-third of the high school population in Arizona) of the Phoenix Union High Schools and Phoenix College System (PUHS & PC).

B. METHOD

1. *Group Utilized*

There were 4,776 9th grade entering students in the PUHS & PC System for the 1957-58 school year, and the 124 students whose scores were utilized for this study were selected as follows: (*a*) random selection process, and (*b*) elimination of ineffective readers.

a. Random selection process. Every fifth name from an alphabetical listing of entering 9th grade students in each of the seven referenced high schools constituted the original sample group (a 20 per cent sample of total group). This group was further reduced by a second selection of every fifth name (a 20 per cent sample of the initial 20 per cent sample). This latter group is referred to as the "initial experimental group" (IEG).

b. Elimination of ineffective readers. The IEG was then screened to eliminate those individuals with a stanine score of three or below on the Cooperative Reading Test (C1-(Y) Lower Level—total score). This elimination of ineffective readers was accomplished to insure that students included

* Received in the Editorial Office on June 1, 1959.

in the "final experimental group" (FEG) (N-124) were capable of reading the test materials included.

c. Final experimental group vs. total freshman group. A comparative examination of the mean test scores for intelligence and reading indicated that the averages for the students in the FEG were significantly higher than the averages for the "total freshman group" (TFG).

The M IQ for the FEG was 106.06 with an SD of 11.64; while the M IQ for the TFG was 101.2 with an SD of 13.02. The difference between M's was 5.0 with a critical ratio value (*t* value) of 4.75 (statistically significant at the 1 per cent level of confidence).

For the FEG the *M* Cooperative Reading score was 44.34 with an SD of 7.45; while the *M* for the TFG was 39.0 with an SD of 11.4. The difference between *M*'s was 5.34 with a *t* value of 7.74 (significant at 1 per cent level). For all tests in referenced 9th grade guidance battery the *M*'s favored the FEG by being on the average approximately two standard score points higher. Differences were not treated for significance, but it was obvious that the students in the FEG were superior on the whole to those in the TFG.

2. *Factorial Study*

Fifteen of the tests used in the PUHS and PC 9th grade entering students' guidance battery were factor analyzed (5 Cassel and Stancik). The following tests presumed to be related to intellectual capability were included in this analysis: (*a*) language score—CTMM, (*b*) Non-language score—CTMM, (*c*) Verbal Reasoning—Differential Aptitude Test Battery (DAT), (*d*) Numerical Ability—DAT, (*e*) Language Usage, Spelling—DAT, (*f*) Language Usage, Sentences—DAT, and (*g*) Vocabulary—Iowa Tests of Educational Development (ITED). Only four of these tests obtained significant loadings on the "intelligence" factor (Factor II): 1, 2, 4, and 6. The loadings for the two parts of the CTMM indicated this test to be best for assessing intellectual capability, as measured by referenced factorial study.

Eight of the tests in the factorial study were representative of the educational experience effectiveness area: (1) Cooperative English—Reading Comprehension, (2) Basic Social Studies—ITED, (3) Natural Science Background—ITED, (4) Correctness of Expression—ITED, (5) Quantitative Thinking, (6) Interpretation of Social Studies, (7) Interpretation of Natural Science, and (8) Interpretation of Literature. Five centroid factors were extracted in which certain of these tests obtained significant loadings, and

they were identified as follows; with the indicated tests suggested for assessment of the respective factors: Factor I—Correctness of Expression—English (4), Factor III—Quantitative (5), Factor IV—Natural Science (7), Factor V—Reading Competency (6), and Factor VI—Basic Social Studies (2).

3. *Expected Achievement Prediction*

a. Independent Variable—Intellectual Capability. The two main raw scores from the California Test of Mental Maturity, Advanced '57 S-Form (CTMM) were utilized for this purpose.

b. Dependent Variables—Effectiveness of Educational Experiences.

(1). *ITED Factorially Pure Composite.* The five scores indicated (Correctness of Expression, Quantitative Thinking, Interpretation of Natural Science, Interpretation of Social Studies, and Basic Social Studies) were used in computing the ITED factorially pure composite. It was a summation of the standard scores for each of the respective tests.

(2). *Freshman Grade Point Average.* The grades given by teachers for the entire freshman year, and for all solid subjects taken, were added and averaged. These grades ranged from 1 to 5, with the 5 representing a failure, and the 1 representing a superior evaluation.

C. Findings

1. *Obtained b Weights for CTMM*

The *b* weights obtained were for the two parts of the CTMM, i.e., Language Raw Score—2½, and Non-Language Raw Score—1. The procedure for computing an "Expected Achievement" Index (XA_b) for a student consists of taking 2½ × Language Raw Score + 1 × Non-Language Raw Score. This index is then converted to a stanine score by use of the data in Table 3. The data in Table 1 was used for developing the referenced *b* weights.

2. *Validating b Weights*

a. Factorial Composite ITED Comparisons. The principal use for an expected achievement score (XA_b) is to predict the achievement of students before they have accomplished the instructional activities. We are interested in making an estimate of the degree of competency in the aggregate subject matter areas. Since the Factorial Composite on the ITED is the best available measure of competency in terms of educational experiences (achievement), it is appropriate to validate the XA_b against it. From Table 2

TABLE 1
INTERCORRELATIONS OF THE LANGUAGE AND NON-LANGUAGE SCORES ON THE CTMM, A FACTORIAL COMPOSITE SCORE ON THE ITED, AND FRESHMAN GPA (N-125)

Variables	(1) Language CTMM	(2) Non-Language CTMM	(3) Factorial Composite ITED	(4) Freshmen GPA (solids)	(5) *Mean*	(6) *SD*
1. Language CTMM		.426	.581	.405	28.57	7.08
2. Non-language CTMM			.400	.671	36.98	4.45
3. Factorial Composite—ITED				.502	65.66	21.05
4. Freshmen GPA					2.87	0.74

r's of .174 statistically significant at 5 per cent level of confidence.
r's of .228 statistically significant at 1 per cent level.

we observe that the correlation between referenced ITED score and the XA_b is .593 (Pearson r).

b. Freshman GPA Comparisons. From Table 2, we observe that the Pearson *r* between the XA_b and Freshman GPA is .404. Obviously, we are not concerned with predicting teacher marks or GPA; and this is an acceptable correlation. If we were concerned with predicting GPA, we would have compiled the *b* weights on the basis of *r*'s with the GPA, rather than the ITED Score. It is of interest to note the Language Raw Score—CTMM correlates .405, and the Non-Language Raw Score correlates .671 against the Freshman GPA. Accordingly, expected achievement scores validated against GPA would obtain correlations equal to or greater than this index.

3. *Attributes of Grade Point Average*

Table 4 contains data related to the attributes or "break-down" of the teacher grades for high school solid subjects for the freshman year of this FEG of students. The most important ingredient is success in communication as measured by the Correctness of Expression Test of the ITED. This attribute is four times as potent as any other ingredient measured by the ITED, reference beta weights. Second to communication, and with about half of the value of the former, is the mathematical and quantitative competency as measured by the Quantitative Thinking Test of the ITED. Also, the reading competency as measured by the Interpretation of Social Studies Test of the ITED contains about one-fourth of that indicated for

TABLE 2

INTERCORRELATIONS OF THE IQ, EXPECTED ACHIEVEMENT SCORES, FACTORIAL COMPOSITE ON ITED, FRESHMAN GPA, M AND SD COMPARISONS FOR MALE AND FEMALE STUDENTS (N-125; 68 MALE, AND 57 FEMALE)

Variables	(1) IQ CTMM	(2) Horn XA_{II}	(3) b Weight XA_b	(4) ITED Composite	(5) Freshman GPA	(6) Mean	(7) SD
1. Intelligence Quotient—CTMM		.836	.884	.593	.489	106.06	11.64
(Male)				.555	.371	106.37	12.01
(Female)				.644	.723	105.66	11.13
(Differences)						0.71	0.88
(t values)						0.34	0.60
2. Horn Expected Achievement—XA_{II}			.833	.531	.361	179.60	12.40
3. b Weight Expected Achievement—XA_b				.593	.404	107.02	21.59
(Male)					.351	107.08	22.60
(Female)					.561	106.92	18.85
(Differences)						0.16	3.75
(t values)						0.04	1.44
4. Factorial Composite—ITED					.502	65.66	21.05
(Male)					.492	67.71	21.53
(Female)					.622	63.04	20.34
(Differences)						4.67	1.19
(t values)						1.24	0.45
5. GPA—Freshman Year (Solids)						2.87	0.74
(Male)						2.50	0.75
(Female)						2.71	0.80
(Differences)						—0.21	—0.05
(t values)						1.50	0.51

r's of .174 significant at 5 per cent, and .228 at 1 per cent level of confidence.
t's of 1.98 significant at 5 per cent level, and 2.62 at 1 per cent level of confidence.

correctness of expression, and one-half that for quantitative thinking. If we were concerned with predicting GPA, the multiple R for the five factorially pure tests of the ITED is .557 ± .061. Only three of the referenced ITED Tests would be used, and the formula would be as follows: 4× Correctness of Expression Standard Score + 2 × Quantitative Thinking Standard Score + 1 × the Interpretation of Social Studies Standard Score.

4. *Sex Comparisons*

From Table 2 it may be observed that there are no significant differences between mean scores for male and female members computed separately for

TABLE 3

STANINE AND T-SCORE EQUIVALENT VALUES FOR THE b WEIGHT EXPECTED ACHIEVEMENT SCORES (XA_b), AND THE FACTORIAL ITED COMPOSITE BASED ON THE TOTAL SCORES FOR THE 4,776 ENTERING 9TH GRADE STUDENTS

	Expected *b* Weight Achievement Scores	Factorial Composite ITED Scores	Stanine Score Equivalents	T-Score Equivalents
	173.38	133.32	9	80
	161.50	121.54	9	75
	149.62	109.76	9	70
	137.74	97.98	8	65
	125.86	86.20	7	60
	113.98	74.42	6	55
	102.10	62.64	5	50
	90.22	50.86	4	45
	78.34	39.08	3	40
	66.46	27.30	2	35
	54.58	15.52	1	30
	42.70	3.74	1	25
	30.82	0.00	1	20
Means	102.10	62.64	5	50
SD's	23.75	23.55	2	10

either of the following: (*a*) I.Q.—CTMM, (*b*) Factorial Composite—ITED, or (*c*) Freshman GPA.

D. SUMMARY

This study was concerned with developing *b* weights for the language and non-language raw scores on the CTMM that would serve as an effective means for computing expected achievement indexes (XA_b) for predicting competency in the usual high school subject matter areas. Fifteen tests used in the regular guidance battery for entering 9th grade students in The Phoenix Union High Schools and Phoenix College System were factor analyzed, and five factors were extracted in the achievement area; with one factor in the intelligence area. The two referenced part scores on the CTMM were suggested, on the basis of factor loadings, to be used for predicting expected achievement. The achievement factors with suggested tests for their assessment were as follows: Factor I—Correctness of Expression (Correctness of Expression—ITED), Factor II—Quantitative (Quantitative Thinking—ITED), Factor IV—Natural Science (Interpretation of Natural Science—ITED), Factor V—Reading Competency (Interpretation of Social Studies—ITED), and Factor VI—Basic Social Studies (Basic Social Studies

TABLE 4

INTERCORRELATIONS OF SCORES FOR TESTS ON ITED FACTORIAL COMPOSITE, AND A MULTIPLE CORRELATION OF THESE TESTS WITH BETA WEIGHTS FOR OPTIMUM PREDICTION OF FRESHMAN GRADE POINT AVERAGE (N-124)

Variables		Multiple correlation				GPA		Multiple regression					Beta Weights		Mean	SD
		X_2	X_3	X_4	X_5	X_6	X_1	1ry	2ry	3ry	4ry	5ry				
1. Basic Social Studies	X_2*	1000	423	618	711	603	364	364	136	003	047	—018	none		13.00	6.10
2. Correctness of Expression	X_3	423	1000	479	499	442	538	(538)	000	(—103)	000	(—045)	390	4	12.30	4.94
3. Quantitative Thinking	X_4	618	479	1000	582	509	474	474	(216)	000	049	—004	216	2	12.60	5.57
4. Interpretation Social Studies	X_5	711	499	582	1000	744	434	434	166	040	(091)	000	091	1	12.80	4.93
5. Interpretation Natural Science	X_6	603	442	442	744	1000	369	369	131	036	082	014	none		12.18	5.91
				R^2		289444	336100	346709	354990	357015						
(Corrected for shrinkage)				R_c^2		283718	325309	330648	333669	330225		$R = .577 \pm .061$				

* Decimals omitted.

—ITED). The *b* weights for predicting expected achievement indexes, with the developed formula, were as follows: 2½ × Language Score (Raw) plus 1 × Non-Language Score (Raw) of the CTMM. This index correlates .593 against the Factorial Composite on ITED. The XA_b on the CTMM together with the referenced five test on the ITED represent a relatively pure factor guidance battery for purpose indicated.

References

1. Cassel, R. Evaluating Instructor Training. *Informational Bulletin,* 1952, **3**, No. 2. (The United States Air Force, Hq. ATC, Scott AFB, Illinois.)
2. Cassel, R., & Braucle, R. Level of aspiration and ego strength comparisons for student council members and a matched group of students from a select high school in South Texas. *High School J.* 1958, **42**, No. 1, 29-32.
3. Cassel, R., & Haddox, G. Leadership testing. *Vocat. Guid. Quart.,* 1959, **7**, No. 3, 189-192.
4. Cassel, R., & Riggs, J. Prediction of scholastic success for first year engineering students at Phoenix College. *Jr. College Journal,* 1959 (in press).
5. Cassel, R., & Stancik, E. The isolation by factor analysis of independent factors in the Iowa Tests of educational development and other tests. (In press.)
6. Horn, A. M. Uneven Distribution of the Effects of Specific Factors. Los Angeles, Calif.: Univ. California Press, 1941.
7. Guilford, J. Fundamental Statistics in Psychology and Education. New York: McGraw Hill, 1956.

501 N. Poppy Street
Lompoc, California

The Journal of Genetic Psychology, 1961, 98, 127-131.

SOME INDICATIONS OF MUSCULAR ARMORING IN TWO SIX-YEAR-OLD RETARDED CHILDREN*

Teachers College, Columbia University

ELIZABETH W. BADGELEY

Observations were made of two six-year-old children, a boy and a girl, pupils in a special experimental class for educable retarded children at the Mental Retardation Project, Teachers' College, Columbia University. The study was a personal one, entirely apart from the original objectives of the Project.

These children were diagnosed retardates with IQ's on the Stanford Binet between 50 and 70. They were drawn from a random sampling of about 30 from three Boroughs of New York City. Children with obvious incapacitating physical and mental abnormalities had been screened out.

My interest in making this particular study had been aroused by the number of children in the Project group who showed peculiarities of posture, poor muscular co-ordination and stereotyped muscular movements. Detailed medical and social histories in most cases led me to believe that there probably existed severe emotional problems overlying or complicating other pre-existing causes of retardation, if any.

Observations of the two children were made mostly through a one-way vision mirror while the children were in the classroom in 10 to 45 minute periods twice a week over a six-week span. A few observations represented direct experiences with the children.

The observations were directed towards facial expression, posture, gait, and notable abnormalities of muscular movement, co-ordinating these where possible with other behavioral expressions such as speech, socialization, emotional states, character structure, etc.

I also undertook to research literature in the field for references which might have immediate bearing on the significance of muscular tensions in relation to development, behavioral patterns and learning, notably material by A. T. Jersild, Josephine Rathbone, Flanders Dunbar, William H. Sheldon, Wilhelm Reich, and others.

Several different disciplines seemed to be aware of muscular tension or

* Received in the Editorial Office on June 8, 1959.

neuromuscular hypertension as presenting a problem to be dealt with therapeutically if possible. Educationists appeared to ignore it. Corrective physical educationists, individual speech therapists, dancers concerned with therapy, had some knowledge of it. Psychoanalysts knew neuromuscular hypertension as existing in relation to emotional states. Sheldon's classification of body types recognized postural mal-development, but was not concerned with muscular tensions or their etiology.

Most productive was Wilhelm Reich's work, primarily *Character Analysis*. Reich uses the term muscular armoring to describe chronic muscular hypertensions which inhibit affect, and dull or distort perception. He states: "They inhibit every kind of excitation, of pleasure, hatred and anxiety alike." Such tensions are accompanied by an inhibition of breathing and characteristic patterns of behavior. In observing patients in treatment Reich was able to relate posture and involuntary muscular movement to characterological and emotional responses.

I found it possible to correlate some of the material from the observations with statements in Reich's work concerning his patients. I felt justified in comparing these observations of the children's behavior with those of adults in treatment since the muscular armor, according to Reich, occurs in layers, the earliest being formed often in early infancy.

Most of the citations which follow are from *Character Analysis*.

> The girl I observed, whom I shall call Louise, was a planned and wanted baby. When she came to the Project her most recent medical diagnosis was "organic brain damage with emotional overlay". The organic brain damage is assumed to have occurred prenatally due to maternal bleeding in the third month of pregnancy. Later developmental history included several episodes which might have been emotionally damaging: possible prematurity, two weeks in an incubator, a tonsillectomy at two and one half years at which time she was weaned from the bottle. Development was slow; she walked at 18 months, and did not show clear speech until three.

Peculiarities of posture and behavior noted were as follows:

> She carried her shoulders constantly high and tense, even when laughing; a posture which might be ascribed to brain damage, but might also be what Reich describes as a "chronically fixed muscular attitude". This posture of high, stiffly-held shoulders expresses anxiety. Two further observations indicated that Louise was an anxious child: from time to time she would stop whatever she was doing and go to look for the teacher, and she gazed repeatedly, apparently compulsively, at herself in the one-way vision mirror.

These are examples of anxious behavior without affective display of anx-

iety. Reich states, "Muscular rigidity can take the place of the vegetative anxiety reaction . . . . Muscular tension which is lasting and is not resolved in motor activity absorbs energies which otherwise would appear as anxiety; that is, the tension prevents the anxiety."

Louise showed facial distortions, nose-wrinkling, a mask-like facial expression, a manner of holding her head and looking to one side. Reich says; "The mechanisms of the pathological displacements and fixations of the vegetative energies (i.e., muscular armor) may be hidden in such phenomena as . . . a slightly mask-like facial expression . . . a certain way of holding the head to one side, of shaking it, etc."

Louise's manner of walking was pigeon-toed with a severely retracted pelvis, a posture which indicates muscular armoring. Reich states; "In the oral and genital sphere, repression is muscularly represented as a tightening of the mouth, a spasm of the throat and in a chronic tension of the pelvic musculature."

The observations showed Louise to be a withdrawing sort of child, participating little, accomplishing practically nothing, showing only occasional pleasure in school activities. Further evidence of the presence of muscular armor lies here. Of reduction of capacity for pleasure and achievement, Reich states; "The ego, the exposed part of the personality, under the continued influence of the conflict between libidinal need and threatening outside world, acquires a certain rigidity, a chronic, automatically functioning mode of reaction, that which is called character. It is as if the affective personality put on an armor, a rigid shell, on which the knocks from the outer world as well as the inner demands, rebound. The armor makes the individual less sensitive to unpleasure, but it also reduces his libidinal and aggressive motility, and with that his capacity for pleasure and achievement . . ."

The boy observed, Jim, was a most charming child who at five years and nine months had a mental age of three years and 10 months. His history showed him to be a foster child, in his fifth foster home placement. He had been the youngest of six children, possibly illegitimate. At 8 months he was hospitalized, possibly because his mother was jailed for alcoholism. At this time he was tested, found bright and alert with a nine months motor level. About this time he was placed in a foster home and weaned from the bottle. There are no clear physical reasons for retardation in his history, but during a second foster home placement it was noted that he had "regressed" and did not talk at 3 years old, and had a mental age of 1 year, 16 months.

Observations of Jim showed:

An alert but silent little boy with a long attention span for orderly work and interest, and good motor co-ordination. Both in earlier and later observations he seemed unusually silent. To quote Reich again; "The character attitude of silence is based on a spasm of the throat musculature of which the patient is unaware and which keeps down excitations as soon as they begin to appear."

Observations also showed a habit of pulling his lips in to make a thin, close mouth which occasionally appeared to twitch towards the right cheek. (In an interview with the speech developmentalist, Jim's imitating of sounds released muscular tensions around the mouth which temporarily brought color and warmth to his face and eyes.) These tensions of mouth and cheek were notably not present when Jim seemed to be relating in any positive way to an adult alone, but appeared when he was in some distant watching relationship to other children. The tucking in of the mouth was sometimes separate from the twitch. Reich says; "voluntary movements of certain muscle groups . . . may serve as defenses against other, involuntary movements, as e.g., (sic) a tic of the eyelid as a defense against sustained staring."

On one occasion in the classroom Jim had been wanting attention from the teacher which he did not get. He showed a sudden outburst of graceful, vigorous, physical activity which took him all over the room and in wordless contact with other children. Reich says; "Many patients succeed in eliminating or at least alleviating genital sensations or anxious sensations by motor unrest. One is reminded of the great role played by motor unrest in children as a discharge of energy."

From evidence such as the foregoing which can be observed without difficulty in a classroom situation, it seems possible that we have here an additional tool by which a trained teacher can help to identify children of potentially higher intelligence whose retardation may stem primarily from severe emotional disturbance and deprivation.

The evidence also points to the fact that there is a crucial need to include facilities for psychotherapeutic treatment in setting up any educational program for young retarded children.

References

1. Dunbar, H. F. Emotions and Bodily Changes: A Survey of Literature on Psychosomatic Interrelationships; 1910-1933. New York: Columbia Univ. Press, 1935.
2. Jersild, A. T. Child Psychology (4th Ed.). New York: Prentice-Hall, Inc., 1954.

3. LAMB, W. Individual Movement Therapy. London: Mental Health, 1954.
4. RATHBONE, J. Corrective Physical Education. Philadelphia: Saunders, 1954.
5. REICH, W. The Function of the Orgasm: The Discovery of the Orgone. New York: Orgone Institute Press, 1948.
6. ———. Character Analysis: Principles and Techniques for Psychoanalysts in Practice and Training. New York: Orgone Institute Press, 1945.
7. SHELDON, W. H. The Varieties of Temperament: A Psychology of Constitutional Differences. New York: Harper, 1944.
8. YOUNG, E. H., & HAWK, S. S. Moto-Kinaesthetic Speech Training. Stanford: Stanford Univ. Press, 1955.

420 Riverside Drive
New York 25, N.Y.

The Journal of Genetic Psychology, 1961, 98, 133-145.

SCHOOL INTERESTS OF EARLY ADOLESCENTS*

Saint Francis College, Fort Wayne, Indiana

SISTER MARY AMATORA, O.S.F.

A. INTRODUCTION

Though research in curricula has gained impetus in the past decade, few studies concerning interests of children and adolescents are related to it. Curricula are, for the most part, organized on the basis of adult-determined needs of pupils. In their efforts to provide what they believe to be the best for the child, educators seldom, if ever, give consideration to pupil interest.

Nonetheless, it is known that various factors in the school influence the pupil in many ways. McCandless and Castenada (11) found a relationship between anxiety and school achievement. Symonds (15) states that much of the incentive for learning comes from intrinsic interests in the activities themselves.

Fagin (5) is of the opinion that the schools should provide outlets for abilities and interests. He further states that frequently interests are neither developed nor guided along proper channels because of distorted concepts of students. Leach (9), in his study of intelligence levels and interest area choices, found persuasive interests ranking relatively low, outdoor area interests high, and computational area interests receiving the highest interest.

In their study of the permanence of school interests, Sterrett and Davis (14) found that retention was influenced by the value of the objective thought. Tyler (16), comparing the interests of English and American school children, found correlations of about .8 between item percentages for the two groups; and correlations of .46 and .47 between the sexes for American and English groups respectively.

The phenomena of mass psychology in the classroom as investigated by Stauffer (13) indicates that repressive interference results in a loss of interest. On the other hand, Harris (7) shows how school interests are modified through enrichment of experiences and enlargement of environmental boundaries.

Analysis of interests in school subjects by Lentke (10) showed boys to be more interested in mathematics, physical education, and the sciences while

* Received in the Editorial Office on June 12, 1959.

girls preferred languages. Neither liked music nor citizenship. As they grew older, boys continued to select more science subjects than language subjects. Rudman (12), studying the informational needs and the reading interests of children in grades four through eight, found that the children are not necessarily interested in reading about the same things they want to ask about. He also found a shift in interest as children proceed from grade to grade.

Albrecht (1) found elementary pupils' lack of interest in achieving to be one cause for lowered achievement in school subjects. Interest, in its relationship to personality adjustment, also effects dropouts, as is revealed by Arnholter's (2) study. In an experimental study of children's attitudes toward school, Fitt (6) found economic status to be positively related to favorable school attitudes. In a study of children's interests in books, Carsley (3) found that for the majority of children, the home offered a better environment for private reading of books than school. May not school interests be a factor in these findings?

B. Purpose

Studies of school interests are usually based upon check lists, inventories, or questionnaires. The writer is of the opinion that an expression of true interest would be achieved more readily if the subjects were completely free to state their interests without suggestion or clue from a ready-made or printed form.

The present investigation of interests of boys and girls in early adolescence endeavors to tap the precise things connected with school life that most interest them. The writer hopes, by using free expression, that the subjects in the experiment will respond freely in order that the study may uncover aspects of young adolescents' interests in school not brought to light by the usual type of research.

C. Method

In order to achieve the purpose of the investigation, the use of current types of check lists, questionnaires, and inventories was ruled out. If boys and girls were to express their interests freely, they would have to be given but a single question, thus allowing the widest possible scope in their answers.

1. *Subjects*

As the study was directed to the young adolescent, it was decided to use a sample of seventh- and eighth-grade boys and girls from widely separated

geographical areas. The 10 cooperating private schools in California, Indiana, Louisiana, Maine, Minnesota, Missouri, North Carolina, Pennsylvania, Texas, and Washington ranged in size from 127 to 956 pupils. Town or city in which they were located ranged in population from 2,000 to 800,000.

2. *Procedure*

A form letter explaining the nature of the research and directions to the children was sent to the principals of the participating schools. Using ordinary tablet paper, children were requested to give age, grade, sex, date, school, city, and state; and then to respond to the question: "What are three of your greatest interests connected with school life, in order of importance to you?"

D. Analyses of Data

After eliminating 12 papers because of incomplete data or illegibility, a total of 679 papers was available for analyses. These included replies from 192 eighth-grade boys, 149 seventh-grade boys, 181 eighth-grade girls, and 157 seventh-grade girls.

Median age for eighth-grade boys was 13.4 $\pm$ 0.4; for seventh-grade boys, 12.2 $\pm$ .05; for eighth-grade girls, 13.1 $\pm$ 0.6; for seventh-grade girls, 12.1 $\pm$ 0.4.

1. *Analyses of Boys' Interest*

An analysis of the boys' interests relative to school life is presented in Table 1. A brief inspection of this table reveals a somewhat diversified interest among the various activities connected with school life.

2. *Degree of Choice in Interest*

In order to differentiate degree of interest in the various interest categories, it was deemed advisable to analyze separately the data for first, second, and third choices of interest.

a. First choice of interest. The first three columns of Table 1 indicate the first choice of interest for the boys in this study. A glance at the third column for total boys' interests shows the largest percentages of interests in four groups, namely, history, spelling, arithmetic, and sports. Collectively these account for more than 40 per cent of the first interests. Next highest interests are in science, 7.1 per cent; religion, 6.8 per cent; and shop 5.1 per cent.

b. Second choice of interest. Among the second choice of school interests

TABLE 1
SCHOOL INTERESTS OF 341 BOYS IN EARLY ADOLESCENCE

Interest categories	First choice			Second choice			Third choice		
	Grade 8	Grade 7	Total	Grade 8	Grade 7	Total	Grade 8	Grade 7	Total
Arithmetic	13.6	6.4	10.0	7.2	2.2	4.7	10.9	0.7	5.9
Art	1.5	5.6	3.5	3.0	1.5	2.3	0.6	7.9	4.2
History	12.1	9.9	11.0	12.8	13.6	13.2	11.5	11.4	11.4
Civics	2.9	1.4	2.1	2.6	0.7	1.7	4.9	1.4	3.1
English	1.5	2.8	2.1	5.1	7.1	6.1	4.9	5.0	5.0
Geography	3.9	3.5	3.8	2.6	13.6	7.6	3.6	5.7	4.6
Languages	0.5	0.7	0.6	0.4	0.7	0.6	0.6	0.7	0.6
Music	0.5	2.8	1.6	0.8	3.6	2.2	1.2	2.1	1.6
Reading	3.9	4.2	4.0	8.1	5.7	6.9	8.6	6.5	7.5
Religion	4.9	8.5	6.8	5.5	5.0	5.3	3.6	10.0	6.8
Science	7.8	6.4	7.1	4.3	4.3	4.3	4.2	3.6	4.0
Social Studies	0.5	1.4	1.0	3.0	2.1	2.6	0.6	1.5	1.0
Spelling	8.2	12.7	10.4	10.2	15.0	12.6	10.9	15.7	13.3
Shop	3.9	6.4	5.1	0.8	2.1	1.4	1.8	0.7	1.3
Library	1.4	1.4	1.4	2.6	0.7	1.6	1.2	1.4	1.3
Study Period	1.9	2.1	2.0	1.3	1.4	1.3	1.2	0.7	0.9
Sports	13.6	6.3	10.0	9.8	5.7	7.7	7.4	5.7	6.5
Friends	1.4	1.4	1.4	2.1	0.7	1.4	1.8	2.1	2.0
Teachers	1.0	2.1	1.5	0.8	1.4	1.6	0.6	2.9	1.9
Lunch Period	1.0	1.4	1.2	1.3	2.1	1.7	4.2	2.1	3.1
Recess Period	3.4	4.2	3.9	3.8	3.6	3.7	3.0	3.6	3.3
Clubs	0.5	1.4	1.0	0.8	0.7	0.8	1.2	1.5	1.3
Activities	1.0	2.1	1.5	1.3	1.4	1.3	1.2	1.4	1.3
Miscellaneous	9.1	4.9	7.0	9.8	5.1	7.4	10.3	5.7	8.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

of these boys one finds two categories emerging high: history, 13.2 per cent; and spelling, 12.6 per cent. Following this there is a considerable drop with lower ranks for sports, 7.7 per cent; geography, 7.6 per cent; reading, 6.9 per cent; and English, 6.1 per cent. Here one finds geography and English emerging in higher percentages than in first choices while arithmetic, religion, science, and shop have dropped to considerably lower percentages. Could the cause here be similar to that indicated by Khan (8) wherein he found pupils disliking geography because it was taught in an uninteresting manner?

c. Third choice of interest. The last column of Table 1 indicates third choice of interest pertaining to school life among the seventh- and eighth-grade boys. Standing out in this column among highest-ranking third interests are spelling, 13.3 per cent, and history, 11.4 per cent. One becomes immediately aware of the fact that these two subjects were among the highest in all choices of interest. A total of 36.3 per cent of all the boys in this study listed spelling as either their first, second, or third interest; and 35.6 per cent listed history as their first, second, or third interest. Thus, one finds approximately three-fourths of the boys in the study expressing an interest in history and spelling. Next highest ranking categories among third interests are reading, 7.5 per cent; religion, 6.8 per cent; sports, 6.5 per cent; arithmetic, 5.9 per cent; and English, 5.0 per cent. Percentages of students expressing interest in the other categories are all considerably smaller.

3. *Grade Level Similarities and Differences*

Further study of Table 1 reveals some similarities and differences between the boys of the seventh and of the eighth grades. It is principally in the non-academic items that one finds similarities in percentages for both groups. The two grade levels are most alike in amount of interest in study and library, in intermissions and in teachers and friends.

In arithmetic, one finds in all three choices of interest a considerable increase in the eighth grade over the seventh grade, with percentages of 13.6, 7.2, and 10.9 respectively for the eighth-grade boys and percentages of 6.4, 2.2, and 0.7 for the seventh-grade boys. Grade-level differences in the same direction are second largest for sports. Here one finds 13.6 per cent, 9.8 per cent, and 7.4 per cent of the eighth-grade boys listing this as their first, second, and third choices respectively; whereas one finds 6.3 per cent, 5.7 per cent, and 5.7 per cent of the seventh-grade boys indicating this item as their first, second, and third choices of interest.

Two other areas of interest indicating grade-level differences, though

smaller, are science and civics. While more eighth graders than seventh graders are interested in these two areas, both differences are small.

Grade-level differences favoring seventh-grade boys are apparent in a number of areas. Largest differences occur in spelling, geography, and shop. In these one finds approximately twice as many seventh graders as eighth graders listing one or other of these items among their first, second, or third choices. Other areas of interest claiming the attention of more seventh graders than eighth graders are religion, social studies, English, music, and art. In these areas one finds about 25 per cent more seventh graders than eighth graders listing an item.

In the remaining three subject-matter areas, namely history, languages, and reading, one finds approximately the same distribution of items listed among seventh- as among eighth-grade boys.

4. *Composite Interest Areas*

For a further analysis of boys' interests, individual item categories were grouped in their respective areas. Thus, one readily perceives from Table 2 the general areas which claim a preponderance of interests of these early-adolescent boys.

A first glance at this table reveals a real interest in science and mathematics among eighth-grade boys. Among seventh-grade boys, interest in this area is considerably less. When one looks at the columns for total interests, one finds the areas for social studies and literature and languages high. Among first choices of interests, differences in the three top-ranking areas are not great; but in the second and third choices of interests, one finds a great increase in the latter two areas. If one considers all items listed by all boys, whether in first, second, or third choice, one finds a total of 63.5 per cent expressing an interest in social studies and a total of 69.8 per cent expressing an interest in literature and languages. This corroborates the findings of Chase (4) in whose experiment boys also had high ranks in these areas. Other subject-matter areas claim but small percentages comparatively. These are the areas of religion, music, art, and shop, claiming totals of 18.8 per cent; 15.5 per cent; and 7.9 per cent, respectively in the combined three choices of interest.

Ranking fourth highest is the area including various items classified as sports, activities, and clubs. These claim a total of 31.6 per cent when all three choices are combined. Items listed under activities included such as programs, plays, field trips and the like. Clubs included such items listed

as Boy Scouts, group meetings, etc. All items listed in this area pertained to these activities held at or in connection with the school.

Other areas of interest listed by these young adolescents may be somewhat surprising. Yet, the study did indicate the preference of some boys for study and library periods and for others, the intermission periods including both the recess and the lunch period. Just why these should be more interesting to the boys than the subject-matter areas is a question worth further investigation. Surprisingly enough, small percentages in all grades and in all three choices were more interested in persons, either teacher or friends, than in school learning.

Items listed by these boys in fewer frequencies were grouped as miscellaneous. These were such items as hobbies, patrol boy duty, last bell, altar boy, school grounds, movies, courtesy lessons, maps, writing, rules, and monitoring.

5. *Analyses of Girls' Interests*

Analyses of girls' interests in school activities is presented in Table 3. Herein one finds the various categories of interest practically the same as those found in the study of boys' interests.

6. *Degree of Choice in Interest*

By comparing the totals given in Columns 3, 6, and 9 of Table 3, one can readily perceive the degree of choice given the various interest areas by the girls in the present study. Examination of these columns portrays some differences from first to second choice and again from second to third choice.

a. First choice of interest. The highest-ranking interest among the girls is quite obviously interest in arithmetic, with 14.6 per cent of all the girls listing this item as their first interest. Second and third interests, considerably lower than arithmetic, are religion, represented by 10.6 per cent; and spelling, 9.4 per cent. The fourth highest interest category is that of sports, claiming a total of 8.0 per cent of all girls. Next in rank are reading, with 7.5 per cent; history, 5.3 per cent; music, 4.8 per cent; and art, 4.1 per cent.

b. Second choice of interest. Several changes are noted in the figures of Column 6 representing the total of the girls' second interests. Highest ranking among these is spelling, claiming 13.4 per cent of all girls. Next in rank is arithmetic, with 10.1 per cent. Following these in order of rank are: religion, 8.7 per cent; English, 8.2 per cent; reading, 7.4 per cent; and

TABLE 3

SCHOOL INTERESTS OF 338 GIRLS IN EARLY ADOLESCENCE

Interest categories	First choice			Second choice			Third choice		
	Grade 8	Grade 7	Total	Grade 8	Grade 7	Total	Grade 8	Grade 7	Total
Arithmetic	13.0	16.5	14.6	8.0	12.1	10.1	8.4	11.1	8.8
Art	2.3	5.9	4.1	4.7	6.7	5.7	3.1	5.0	4.1
History	4.2	6.5	5.3	3.8	4.9	4.4	6.3	9.9	8.2
Civics	3.3	1.1	2.2	3.8	1.2	2.5	2.1	1.9	2.1
English	5.1	1.1	3.1	8.5	7.9	8.2	5.8	8.0	7.1
Geography	0.5	1.1	0.8	2.4	2.4	2.4	1.1	2.5	1.9
Languages	4.2	1.2	2.7	0.5	0.7	0.6	1.6	0.6	1.2
Music	3.7	5.9	4.8	1.9	4.2	3.1	5.8	4.3	5.1
Reading	7.4	7.6	7.5	5.1	9.7	7.4	13.6	6.2	10.1
Religion	10.9	9.4	10.6	7.0	10.3	8.7	7.8	7.4	7.7
Science	1.4	2.3	1.8	5.6	3.1	4.3	3.7	2.5	3.2
Social Studies	2.0	1.2	1.6	0.9	1.8	1.3	0.5	1.2	0.9
Spelling	8.8	10.0	9.4	14.1	12.7	13.4	4.7	14.8	8.8
Library	2.8	1.2	2.0	2.4	0.6	1.5	4.2	0.6	2.5
Study Period	0.9	1.8	1.3	1.4	1.2	1.3	0.5	1.2	0.9
Sports	8.4	7.7	8.0	10.7	2.4	6.5	5.2	4.3	4.8
Friends	1.4	1.2	1.3	1.4	1.2	1.3	2.6	3.1	2.9
Teachers	2.3	2.9	2.6	0.9	1.2	1.0	3.7	3.7	3.7
Lunch Period	0.5	0.6	0.5	1.4	1.2	1.3	2.6	0.6	1.7
Recess Period	3.3	7.1	5.2	2.8	2.4	2.6	2.1	1.8	2.0
Clubs	3.3	1.2	2.2	2.4	0.6	1.5	1.5	0.6	1.1
Activities	1.4	1.2	1.3	2.3	2.4	2.4	3.1	4.3	3.8
Miscellaneous	8.9	5.3	7.1	8.0	9.1	8.5	10.0	4.4	7.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

sports, 6.5 per cent. Other areas showing a lesser degree of interest among the girls include art, 5.7 per cent; history, 4.4 per cent; science, 4.3 per cent; and music, 3.1 per cent.

c. Third choice of interest. The third choices of interests as indicated by the girls in this study are again quite different in rank order from both the first and the second interests. As given in the last column of Table 3, the highest ranking third interest is reading, 10.1 per cent. Subjects closely following this are arithmetic, 8.8 per cent; spelling, 8.8 per cent; history, 8.2 per cent; religion, 7.7 per cent; and English, 7.1 per cent. Other areas of interest, considerably smaller, include music, 5.1 per cent; sports, 4.8 per cent; art, 4.1 per cent; and science, 3.2 per cent.

7. *Grade-Level Similarities and Differences*

A comparison of the percentages for seventh- and eighth-grade girls reveals a number of similarities and differences. At a glance one notes in all six columns that most of the higher ranking areas are similar for both grade levels; likewise are grade-level similarities noted in areas having least interest.

Several areas of interest show larger percentages among eighth-grade girls than among seventh-grade girls. The former show a greater degree of interest in the areas of English, languages, civics and sports. One finds appoximately twice as many, or more, eighth-grade girls listing one of these areas as their first, second, or third interest as seventh-grade girls.

The direction of difference is the opposite for other areas of interest. More seventh-grade girls than eighth-grade girls are interested in arithmetic, history, geography, science, art, spelling, and music. In these areas, for all three choices of interests combined, one finds from 10 to 30 per cent more seventh-grade girls than eighth-grade girls.

For two areas of interest, namely religion and reading, one finds very little grade-level difference.

8. *Composite Interest Areas*

Individual items of interest expressed by girls were grouped in their respective areas. These are presented in Table 4, which reveals a preponderance of interest in the area of literature and languages with 22.7 per cent as total first choice; 29.6 per cent, second choice; and 27.6 per cent, third choice. Thus, in all three choices of interest, a total of 79.9 per cent of different girls in the study listed an item in this general area in their free expression of school interests.

TABLE 4
COMPOSITE INTEREST AREAS OF GIRLS

Interest areas	First choice			Second choice			Third choice		
	Grade 8	Grade 7	Total	Grade 8	Grade 7	Total	Grade 8	Grade 7	Total
Math and Science	14.4	18.8	16.6	13.6	15.2	14.4	12.1	13.6	12.9
Social Studies	10.0	9.9	9.9	10.9	10.3	10.6	10.0	15.5	12.8
Literature and Languages	25.5	19.9	22.7	28.2	31.0	29.6	25.7	29.6	27.6
Art and Music	6.0	11.8	8.9	6.6	10.9	8.8	8.9	9.3	9.1
Religion	10.9	9.4	10.2	7.0	10.3	8.7	7.8	7.4	7.6
Study and Library	3.7	3.0	3.3	3.8	1.8	2.8	4.7	1.8	3.3
Intermissions	3.8	7.7	5.8	4.2	3.6	3.9	4.7	2.4	3.5
Sports, Clubs and Activities	13.1	10.1	11.6	15.4	5.4	10.4	9.8	9.2	9.5
Friends and Teachers	3.7	4.1	3.9	2.3	2.4	2.3	6.3	6.8	6.5
Miscellaneous	8.9	5.3	7.1	8.0	9.1	8.5	10.0	4.4	7.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Though the percentages in all cases are somewhat smaller, interest in science and mathematics ranks second among the girls in both grades and for most choices. Among first choices of interest, religion ranks third with 10.2 per cent but falls to fifth rank in second and third choices.

In the first choice of interest, social studies area and music and art area rank fourth and fifth respectively with 9.9 per cent and 8.9 per cent of the girls indicating these areas. In second and in third choices, social studies rises to third rank and music and art area rises to fourth place.

A number of girls expressed interest in non-subject-matter areas. Among these the general area including clubs, sports and activities ranks highest with 11.6 per cent of the girls expressing this as their first choice of interest; another 10.4 per cent, as their second choice; and still another 9.5 per cent, as their third choice. Grade-level differences are also apparent here in that more eighth-grade girls expressed this interest than did seventh-grade girls.

Another group of girls found their chief school interest in people at school, including teachers and friends. This claims a total of 12.7 per cent of the girls in all three choices of interest. A slightly larger group of girls expressed their chief interest at school as the times of intermissions, including both the lunch hour and the recess period. Items of interest listed under miscellaneous include: writing, clothes, newspapers, piano, stories, home economics, vocations, and walks.

E. Summary

A study of the school interests of 679 young adolescents from widely separated geographical regions of the United States was carried out in an experiment designed to elicit their true interests by giving them complete freedom in their expression of school-related interests. Tabulation of all items was made separately for sex and for grade level. Data were analyzed for each group according to (*a*) degree of choice in each interest category, (*b*) grade-level similarities and differences, and (*c*) composite interest areas.

References

1. Albrecht, K. Wesensbild einer grosstadtischen Volksschulklasse von vierzehnjahrigen Jungen. *Prax. Kinderpsychol. Kinderpsychiat.*, 1955, **1**, 24-26.
2. Arnholter, E. G. School persistence and personality factors. *Person. Guid. J.*, 1956, **35**, 107-109.
3. Carsley, J. D. The interests of children in books. *Brit. J. Educ. Psychol.*, 1957, **27**, 13-23.
4. Chase, W. L. Subject preferences of fifth-grade children. *Elem. Sch. J.*, 1949, **50**, 204-211.

5. FAGIN, B. Guiding the vocational interests of the child. *Education*, 1953, **74**, 171-179.
6. FITT, A. B. An experimental study of children's attitude to school in Auckland, N. Z. *Brit. J. Educ. Psychol.*, 1956, **26**, 25-30.
7. HARRIS, D. B. How children learn interests, motives, and attitudes. *In* Henry, N. B., *49th yearbook NSSE, Part I*, 129-155.
8. KHAN, M. H. Attitude of the pupils toward geography. *J. Educ. Psychol.*, 1950, **8**, 153-157.
9. LEACH, K. W. Intelligence levels and corresponding interest area choices of ninth grade pupils in thirteen Michigan schools, *J. Exp. Educ.*, 1954, **22**, 369-383.
10. LENTKE, H. M. Eine Erhebung an hoheren Schulen uber das Interesse an den Schulfachern, insbesondere an der Biologie. *Psychol. Beitr.*, 1956, **2**, 308-326.
11. MCCANDLESS, B. R., & CASTENADA, A. Anxiety in children, school achievement, and intelligence. *Child Devel.*, 1956, **27**, 379-382.
12. RUDMAN, H. C. The informational needs and reading interest of children in grades IV through VIII. *Elem. Sch. J.*, 1955, **55**, 502-512.
13. STAUFFER, E. Massenpsychologische Phanomene in der schule. *Heilpadag. Werkbl.*, 1954, **23**, 238-244.
14. STERRETT, M. D., & DAVIS, R. A. The permanence of school learning; a review of studies. *Educ. Adm. Superv.*, 1954, **40**, 449-460.
15. SYMONDS, P. M. What education has to learn from psychology. *Teach. Coll. Rec.*, 1955, **56**, 277-285.
16. TYLER, L. E. Comparison of interests of English and American school children. *J. Genet. Psych.*, 1956, **88**, 175-181.

Department of Psychology
Saint Francis College
Fort Wayne, Indiana

The Journal of Genetic Psychology, 1961, 98, 147-154.

MEASURING THE TEACHER'S EFFECTIVENESS AS A LECTURER*

Bureau of Educational Research, College of Education, University of Illinois

STANLEY A. RUDIN[1,2]

A. INTRODUCTION

Every attempt to relate predictor variables to the ability of a teacher to teach well has encountered the problem of defining and measuring the criterion (Morsh, J. E., & Wilder, Eleanor, W., 1954). Generally speaking, there have been two main solutions to this difficulty: (*a*) accepting the judgments of supervisors, peers, pupils, and other presumably qualified persons as to the capability of the teacher on a number of variables, and (*b*) devising or utilizing some kind of situation in which the teacher's ability can be measured by testing his pupils before and after instruction and comparing the increase in their scores with some standard. The latter course permits the experimenter (*E*) to obtain a performance measure of the extent to which the teacher's influence has brought about a gain in the variables being measured, since it is assumed that with all other variables held constant, any increment in the pupil's performance will be due to the teacher's influence. It has the advantage of being less susceptible to halo and other sources of invalidity in ratings and the disadvantage of being difficult to use, since measurements of many pupils over a lengthy period of time and more than one testing session are frequently necessary. If a variant of the method of pupil gains that would be easier to use could be devised, it would be of value as a criterion measurement in studies of teacher effectiveness.

* Received in the Editorial Office on June 15, 1959.

1 This investigation was supported by a research grant (M-650) to N. L. Gage as principal investigator from the Institute of Mental Health, National Institutes of Health, Public Health Service. The study was carried out while the author was Research Assistant Professor in the Bureau of Educational Research, University of Illinois.

2 A more detailed form of this paper (or extended version, or material supplementary to this article) has been deposited as Document number 6433 with the ADI Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington 25, D. C. A copy may be secured by citing the Document number and by remitting $1.25 for photoprints, or $1.25 for 35 mm. microfilm. Advance payment is required. Make checks or money orders payable to: Chief, Photoduplication Service, Library of Congress.

This paper reports the preliminary trial of such a method. Its procedure is as follows: (*a*) pupils are administered a science information test, (*b*) the teacher delivers a short, self-prepared lecture on a specific scientific topic, and (*c*) an achievement test on that topic is administered. The whole procedure takes about an hour. The measure of the teacher's ability is inferred from the direction and size of the mean discrepancy between the achievement test score as predicted by the science information test and the actual achievement test score. It is assumed that use of the science information test holds constant the factors of pupil's intelligence, previous knowledge, and pre-test interest in science, since numerous studies have shown these three factors to be the major determinants of achievement test scores. The dependent variable is then *teacher's ability to inculcate information.*

B. Necessity for a Pilot Study

Before using such a procedure as part of the criterion in an attempt to predict teacher effectiveness by psychological tests, it is necessary both to confirm certain of its assumptions and to assess the practical difficulties involved. This permits a better evaluation of the method. This study seeks answers to two major questions: (*a*) is the procedure simple and foolproof enough to be practical, and (*b*) does sufficient variance between teachers' classes exist to permit reliable measurement? The latter question is the more equivocal. It is conceivable that with the tests, teachers, and classes found in the ordinary school, so much variance would exist *within* the classes as to obscure any differences *between* them on the achievement test.

Answering the first question involves merely assembling the materials, trying them out on a small group, and observing what happens.

Answering the second question is not as easy. The method used here involves performing an analysis of covariance of the achievement test scores of each teacher's class, with pre-lecture science information held constant. A significant F ratio of this analysis of covariance would then support the hypothesis that with intelligence, previous knowledge, and interest held constant by the Science Information test, there is a sufficient amount of variance between each individual teacher's classes to warrant the assumption that measurable differences exist. This in turn would support our use of the procedure as a measure of the teacher's lecturing effectiveness.

C. Method

1. *Subjects*[3]

Seven student teachers in the College of Education, University of Illinois, served as subjects. Five were women. Although 11 actually went through the procedure, the results from four had to be discarded, for reasons to be described. Their classes ranged from 22 to 32 pupils of both sexes in the fifth and sixth grades. They taught in several schools, all of which were about average or a little above.

2. *Test Materials*

These consisted of three documents, two tests and a lecture booklet.

a. Science Information Test. This test consisted of Test C, "Physical Changes," 20 items, and Test D, "Other Science," 15 items, from the *Calvert Science Information Test—Elementary Form A*, California Test Bureau. All were four-alternative multiple-choice items.

b. Lesson Achievement Test.[4] Devised by Rudin and Gage, this test consisted of 32 four-alternative multiple choice items. In writing them, an effort was made to cover both the more specific data of the lecture and material of a more general nature, such as the general physical principles involved and the two or three main points of the article. They were worded at about the fifth and sixth grade level.

c. Lecture. Our choice of lecture material was guided by the following considerations. First, it had to be short enough to be read within a couple of hours by the average teacher, yet long enough to provide sufficient material for the lecture. Second, it had to be of a level of difficulty such that the teachers could grasp it with a moderate amount of concentration, but that fifth and sixth grade pupils could understand it only after explanation and simplification. Third, it had to contain both concrete, specific facts, and general principles.

The article, "Volcanoes and World Climate," by Harry Wexler, from the April, 1952, issue of *Scientific American* magazine, was presented in mimeographed booklets.[5] Although the original article had pictures and figures illustrating the text, we deemed them unnecessary for a sufficient understanding of the text and did not reproduce them.

---

[3] We wish to thank Professor Fred Barnes and his students of the College of Education for their cooperation.

[4] See page 147 footnote 2.

[5] We wish to thank the editors and publishers of *Scientific American* for permitting us to copy and use this article.

3. *Procedure*

The subjects were met twice by *E*, who instructed them in the procedure, materials, and purpose of the study and answered questions. All seemed interested and cooperative. At the first meeting of the large class from which they had been drawn, the test materials were distributed. These consisted of the two sets of tests and a set of instructions, which may be summarized as follows:

First, tell the children that they are going to do something different today. Give the Science Information Test, allowing 10 minutes. This is not primarily a speed test, so if some children do not finish, give them extra time.

Second, present your lecture on the material. You may present it any way you like. Allow 20 minutes for this. Stay as close to this limit as possible.

Third, allow a five-minute discussion period.

Finally, give the Lesson Information Test, allowing 10 minutes; but again, this is not a speed test and the children can have longer if they need it. *Do not look at either test until you give them out.* This is most important. When you have finished, put them in the envelope and return everything to the experimenters.

Subjects were also asked to write out answers to several questions regarding the entire process.

D. Results

Of the original subjects, the data of only seven could be used. One admitted to having forgotten the time limit and lectured for about 40 minutes. The other three taught the fifth grade, and inspection of the papers made it clear that the tests were too difficult for most of these children. About half of these teachers' pupils did not finish the first three-quarters of one or both tests. While it would have been possible to extrapolate and obtain an estimated score for these pupils' tests, their unknown but probably low reliability argued against such a move. Moreover, the use of only seven subjects, though decreasing the reliability of our findings, still permitted our hypothesis to be tested.

1. *General Observations*

The teachers were practically unanimous in declaring the tests too long for the 10-minute time limits. Estimates of a more appropriate time ranged from 15 to 40 minutes, with most agreeing that about 20 to 25 minutes

would be adequate for at least the majority. This was especially marked in the case of the achievement test, but was true of both.

There are two ways to remedy this problem. One is to lengthen the time permitted and the other is to shorten the tests. The first would make the method more unwieldy and time-consuming, thus increasing teacher resistance and making validity studies using this technique more difficult. The second would lower test reliability. Our preference is for the latter method, since the loss in test reliability would in a sense be compensated for by the fact that the score of a teacher is based on the average of several pupils' scores. It would probably be possible to calculate the minimal number of pupils in a class that would permit a reliable gain score to be derived. Also, an item analysis would permit discarding the most useless items.

The only other objection raised with any frequency was that the lecture material was not suitable for children of this age range. As pointed out previously, however, this was considered a desirable attribute from the experimenter's point of view. In addition, two teachers found difficulty in keeping the lecture and discussion within the time limits. It can be argued, however, that the ability to plan the presentation of material to occupy exactly a given time interval is itself part of the behavior we wish to measure.

In general, we regard the data from the teacher's questionnaire as encouraging. Except for the inapproriate time limits on the tests, the procedure seems to have gone smoothly enough, the teachers receiving it as a challenging classroom exercise, the pupils finding it a welcome change of routine. While not all would be expected to regard it this way in future instances, it seems unlikely that it would arouse strong resistance.

2. *Reliability of the Procedure*

This section attempts to answer the question, "With initial ability, knowledge, and interest held constant, will there be measurable differences in the average achievement level of the various classes?" The technique used, it will be recalled, is the analysis of covariance. Three separate analyses were computed: the total group, the fifth grade classes, and the sixth grade classes. While that of the total group is most directly concerned with our question, breaking the data down in this manner gives even greater control over irrelevant variables such as age, initial ability level, ability to concentrate, and so on. It might also reveal differences between classes worth further investigation.

a. Total group. The relevant results from the seven classes are presented

in Tables 1, 2, and 3.[6] As can be seen, mean scores of the groups on each of the two tests differ significantly from one another, and the Lesson Achievement Test scores differ significantly with Science Information held constant. This latter finding supports the major hypothesis of this study, and answers in the affirmative our question regarding the presence of relevant variance with ability held constant.

b. Fifth grade. Results of the analysis of the four fifth grade classes appear in Tables 4, 5, and 6. Unlike the total group, there are no significant differences among the means of the four classes on either of the tests alone, although the analysis of covariance is significant. This establishes that there are indeed instances in which the irrelevant variance within classes is so great as to obscure the relevant variance between classes, and demonstrates the efficacy of the Science Information Test in holding this variable constant.

c. Sixth grade. Tables 7, 8, and 9 present the results of the analyses of these three classes. Here, the results are generally the same as those for the total group, except that the *F*-ratio for the Science Information Test just barely misses significance.

3. *Correlations Between the Tests*

One final set of information may be gleaned from the data. Correlations between the Science Information Test and the Lesson Achievement Test would show exactly how good a control variable the pre-test was, both over all the subjects and within each grade.

The Pearson *r* over all the subjects ($N = 181$) was .70. Correlations within the four fifth grade classes were: .53 ($N = 23$), .70 ($N = 22$), .76 ($N = 27$), and .72 ($N = 24$). Those within the sixth grade were: .68 ($N = 22$), .71 ($N = 30$) and .65 ($N = 33$).

The correlations demonstrate that the factors measured by the Science Information Test account for roughly half the variance of the Lesson Information Test. The relatively small size of the total sample and the subsamples does not permit reliable comparisons to be made between the fifth and sixth grades.

Considered in relation to the general purpose and nature of our method, these results suggest that the pre-test is controlling the irrelevant variables optimally. Too high a correlation would leave no "room" for the teacher's ability to influence the achievement test scores and too low a relationship would leave the achievement test scores open to influence by unknown variables, making interpretation ambiguous.

[6] See page 147 footnote 2.

E. Discussion

In general these results are encouraging. The Lecture Effectiveness Test promises to be of value in operationally defining, for research purposes, one component of the total complex called teacher effectiveness. In actual practice, E would, of course, predict the score on the Lesson Achievement Test for each teacher's class by means of a regression equation from the Science Information Test. The actual score would then be subtracted from the predicted one for each teacher.

It is of the greatest importance to note that this method should be used *only* after local norms and a regression equation based on them have been obtained. Moreover, since the exact psychological meaning of the discrepancy scores is still uncertain, it would be safer to use them only to obtain rankings of the teachers within a given sample.

Certain aspects of our findings suggest the need for modification and extensive further research before this method may be regarded as a trustworthy tool. As previously noted, certain concrete changes in form are necessary. Both tests should be shortened with the aid of an item analysis and their reliabilities ascertained.[7] The items of the Lesson Achievement Test should be checked by others to make sure that they faithfully reflect the content of the lecture.

Other types of lecture material may be tried. This would be particularly important in cases where the school system emphasizes or de-emphasizes the type of material in the lecture, where there is a possibility of sex differences in the pupils being important, and where grades other than those we used (the fifth and sixth) are to be tested.

Research should be directed at strengthening the weakest point of our argument, viz., that with the ability level of the pupils held constant, differences between classes will be due only to the teacher's teaching ability. Correlation of this measure with other, older measures—such as pupils' ratings—would help, although it is conceivable that there is more than one kind of "effectiveness" and that these are not necessarily highly correlated. In that case, further proof of reliability, which at this stage is highly desirable, would become absolutely necessary.

One kind of reliability that future research might probe is that over time. How repeatable is the teacher's performance? Another kind would be over

[7] Since for all practical purposes the difficulty those fifth grade pupils who did not finish encountered was due more to test length than to item difficulty, shortening the tests and setting more appropriate time limits would permit its use with fifth graders.

pupils. Do the same teachers achieve the same results with different pupils? This method could be adapted to studies of teacher-pupil interaction by systematically matching "types" of pupils and "types" of teachers. Finally, reliability over lecture material should be investigated. Can a teacher who lectures well on volcanoes also lecture well on earthquakes or on the meaning of art? Such questions lend themselves to carefully designed, well-controlled studies whose only drawback would be their relatively great expense.

Pending further research, the method can be used tentatively as it is. There are, however, important qualifications that must be observed at this stage of its development. First, until further evidence of its reliability and validity is adduced, it should be used only in conjunction with older, tested criterion measures. Second, its use should be restricted to the grades used here. There is ample evidence suggesting that the tests would be much too difficult for fourth graders and too easy for seventh graders. Third, it should be used only where ample time and money is available. At this point, it is (and probably will be for some time) a relatively cumbersome, expensive procedure. Finally, it is recommended that it be used in studies of small, extreme groups, which have been previously obtained by the use of some easier method.

F. Summary

This study investigated the feasibility of developing a criterion measure of teacher's effectiveness at conveying scientific material by lecture. Seven student teachers administered a general science information test, delivered a short lecture on a specific article from *Scientific American* magazine, and then administered a test of knowledge of the material contained in the lecture. Analyses of covariance showed that with level of original scientific information held constant, reliable individual differences existed between teachers. The results were interpreted as supporting the view that with further suggested refinements the method can be used to measure the teacher's ability to convey information by lecture.

Reference

1. Morsh, J. E., & Wilder, E. W. Identifying the effective instructor: a review of the quantitative studies, 1900-1952. Research Bulletin AFPTRC-TR-54-44: Air Force Personnel & Training Research Center, Lackland Air Force Base, Texas, 1954.

School of Psychology
Georgia Institute of Technology
Atlanta 13, Georgia

The Journal of Genetic Psychology, 1961, 98, 155-157.

BOOKS

Now that there is a special *APA* journal completely devoted to the publication of book reviews, it is no longer necessary that other journals emphasize such publication. It has always been our conviction that book reviews are a secondary order of publication unless they carry information that is just as important as the book. However, the publication of book titles is a very important service, and we shall continue to render that service.

In any given issue of this journal, we may continue to publish one or more book reviews, but we do not consider such publication a major function of this journal. In line with this policy, we can no longer pay for such manuscripts.

BOOKS RECENTLY PUBLISHED

ABRAMSON, H. A., *Ed.* Neuropharmacology. New York: Josiah Nach, Jr., 1960. Pp. 251.

ADDAMS, J. A Centennial Reader. New York: Macmillan, 1960. Pp. 330.

ALEXANDER, F. The Western Mind in Transition. New York: Random House, 1960. Pp. 300.

ASHBY, W. R. Design For a Brain. New York: Wiley, 1960. Pp. 286.

BECK, S. J. The Rorschach Experiment. New York: Grune & Stratton, 1960. Pp. 256.

BRAMMER, L. M., & SHOSTROM, H. L. Therapeutic Psychology. Englewood Cliffs, N.J.: Prentice-Hall, 1960. Pp. 447.

BRODY, M. W. Observations on Direct Analysis: The Therapeutic Technique of Dr. John N. Rosen. New York: Vantage, 1959. Pp. 104.

CHEN, T. H. E. Thought Reform of the Chinese Intellectuals. Hong Kong: Hong Kong Univ. Press, 1960. Pp. 247.

CORY, D. W. The Homosexual in America. New York: Castle, 1960. Pp. 334.

DAHLSTROM, W. G., & WELSH, G. S. An MMPI Handbook. Minneapolis: Univ. Minnesota Press, 1960. Pp. 559.

DAVID, H. P., & BRENGELMANN, J. C., *Eds.* Perspectives in Personality Research. New York: Springer, 1960. Pp. 370.

DYER, M. The Weapon on the Wall: Rethinking Psychological Warfare. Baltimore: Johns Hopkins Press, 1959. Pp. 269.

FEIPEL, H., *Ed.* The Meaning of Death. New York: Blakiston Div., McGraw-Hill, 1959. Pp. 351.

FISHER, M. B., & NOBLE, J. L. College Education as Personal Development. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1960. Pp. 375.

FUJISAWA, C. Zen and Shinto: The Story of Japanese Philosophy. New York: Philosophical, 1959. Pp. 92.

FULLER, J. L., & THOMPSON, W. R. Behavior Genetics. New York: Wiley, 1960. Pp. 396.

GORLOW, L., & KATKOVSKY, W., *Eds.* Readings in the Psychology of Adjustment. New York: McGraw-Hill, 1959. Pp. 541.

GULLIKSEN, H., & NESSICK, S. Psychological Scaling: Theory and Applications. New York: Wiley, 1960. Pp. 211.

HAGMAIER, G., & GLEASON, R. W. Counseling the Catholic: Modern Techniques and Emotional Conflicts. New York: Shood & Ward, 1959. Pp. 301.

HALL, B. H., *Ed.* A Psychiatrist's World: The Selected Papers of Karl Menninger, M.D. New York: Viking, 1959. Pp. 931.

HALMOS, F. R. Naive Set Theory. Princeton: Van Nostrand, 1960. Pp. 104.

HARTLEY, E. L., & WIEBE, C. D. Casebook in Social Processes. New York: Crowell, 1960. Pp. 534.

HARTMANN, H. Psychoanalysis and Moral Values. New York: International Univ. Press, 1960. Pp. 121.

JANOWITZ, M. The Professional Soldier: A Social and Political Portrait. Glencoe: Free Press, 1960. Pp. 464.

JENNINGS, E. E. An Anatomy of Leadership. New York: Harper, 1960. Pp. 256.

JERSILD, A. T. Child Psychology. Englewood Cliffs, N.J.: Prentice-Hall, 1960. Pp. 506.

JOHNSON, G. O., & BLAKE, K. A. Learning Performance of Retarded and Normal Children. Syracuse: Syracuse Univ. Press, 1960. Pp. 216.

JOHNSON, W. R., *Ed.* Science and Medicine of Exercise and Sports. New York: Harper, 1960. Pp. 740.

JONES, R. M. An Application of Psychoanalysis to Education. Springfield, Ill.: Thomas, 1960. Pp. 124.

KATONA, G. The Powerful Consumer: Psychological Studies of the American Economy. New York: McGraw-Hill, 1960. Pp. 276.

KLOPFER, W. G. The Psychological Report. New York: Grune & Stratton, 1960. Pp. 146.

KRONHAUSEN, P. & KRONHAUSEN, E. Sex Histories of American College Men. New York: Ballantine, 1960. Pp. 313.

KROUT, M. H., *Ed.* Psychology, Psychiatry, and the Public Interest. Minneapolis: Univ. Minnesota Press, 1956. Pp. 217.

LANDY, D. Tropical Childhood: Cultural Transmission and Learning in a Rural Puerto Rican Village. Chapel Hill: Univ. N. Carolina Press, 1959. Pp. 291.

LANGFORD, L. M. Guidance of the Young Child. New York: Wiley, 1960. Pp. 349.

LENNARD, H. L., & BERNSTEIN, A. The Anatomy of Psychotherapy: Systems of Communication and Expectation. New York: Columbia Univ. Press, 1960. Pp. 209.

LEVITT, M. Freud and Dewey on the Nature of Man. New York: Philosophical, 1960. Pp. 180.

LICHTENBERG, P., KOHRMAN, R., & MAC GREGOR, H. Motivation For Child Psychiatry Treatment. New York: Russell & Russell, 1960. Pp. 220.

LUCHINS, A. S., & LUCHINS, E. H. Rigidity of Behavior: A Variational Approach to the Effect of Einstellung. Eugene: Univ. Oregon Books, 1959. Pp. 623.

MACDONALD, L. Leadership Dynamics and the Trade-Union Leader. New York: New York Univ. Press, 1959. Pp. 156.

MACGREGOR, F. C. Social Science in Nursing: Applications for the Improvement of Patient Care. New York: Russell Sage, 1960. Pp. 354.

MACK, S. F. Elementary Statistics. New York: Henry Holt, 1960. Pp. 198.

MANN, F. C., & HOFFMAN, L. R. Automation and the Worker: A Study of Social Change in Power Plants. New York: Henry Holt, 1960. Pp. 272.

MARTIN, P. C., & VINCENT, E. L. Human Development. New York: Ronald Press, 1960. Pp. 541.

MILLEN, J. K. Your Nose Knows: A Study of the Sense of Smell. Los Angeles: Cunningham, 1960. Pp. 166.

MILLER, K. S. An Introduction to the Calculus of Finite Differences and Difference Equations. New York: Henry Holt, 1960. Pp. 167.

MITCHELL, A. The Healing Trance: A Doctor's Story of Hypnosis. New York: Barnes, 1960. Pp. 248.

MOORE, E. H. Fives at School: Teaching in the Kindergarten. New York: Putnam's Sons, 1959. Pp. 333.

MOWRER, O. H. Learning Theory and Behavior. New York: Wiley, 1960. Pp. 555.

MURRAY, B. D. Commonwealth of Americans: A Search for the Missing Chapters of Our Story. New York: Philosophical Library, 1959. Pp. 219.

NETT, R., & HETZLER, S. A. An Introduction to Electronic Data Processing. Glencoe: Free Press, 1959. Pp. 287.

NEUSTADT, R. E. Presidential Power: The Politics of Leadership. New York: Wiley, 1960. Pp. 224.

OLYANOVA, N. The Psychology of Handwriting. New York: Sterling, 1960. Pp. 224.
OPLER, N. K., *Ed.* Culture and Mental Health: Cross-Cultural Studies. New York: Macmillan, 1959. Pp. 533.
PARKER, W. V., & EAVES, J. C. Matrices. New York: Ronald Press, 1960. Pp. 195.
PHILLIPS, E. L., WIENER, D. N., & HARING, N. C. Discipline, Achievement, and Mental Health. Englewood Cliffs, N.J.: Prentice-Hall, 1960. Pp. 198.
PITTMAN, D. J., *Ed.* Alcoholism: An Interdisciplinary Approach. Springfield: Charles C. Thomas, 1959. Pp. 96.
PORTEOUS, S. D. The Maze Test and Clinical Psychology. Palo Alto, Calif.: Pacific Books, 1959. Pp. 203.
READ, K. H. The Nursery School: A Human Relationships Laboratory. Philadelphia: Saunders, 1960. Pp. 333.
REIFF, R., & SCHEERER, M. Memory and Hypnotic Age Regression: Developmental Aspects of Cognitive Function Explored Through Hypnosis. New York: Intern. Univ. Press, 1959. Pp. 253.
ROKEACH, M. The Open and Closed Mind: Investigations into the Nature of Belief Systems and Personality Systems. New York: Basic Books, 1960. Pp. 447.
RUBIN, T. I. Jordi. New York: Macmillan, 1960. Pp. 73.
RUNES, D. D. Pictorial History of Philosophy. New York: Philosophical Library, 1959. Pp. 406.
SARASON, S. B., DAVIDSON, K. S., LIGHTHALL, F. F., WAITE, R. R., & RUEBUSH, B. K. Anxiety in Elementary School Children. New York: Wiley, 1960. Pp. 351.
SIEGEL, B. J., *Ed.* Biennial Review of Anthropology, 1959. Stanford, Calif.: Stanford Univ. Press, 1959. Pp. 273.
SIMPSON, G. People in Families. New York: Crowell, 1960. Pp. 554.
SLOTKIN, J. S. From Field to Factory: New Industrial Employees. Glencoe, Ill.: Free Press, 1960. Pp. 156.
SLONIM, M. J. Sampling in a Nutshell. New York: Simon & Schuster, 1960. Pp. 265.
STOODLEY, B. H. The Concepts of Sigmund Freud. Glencoe: Free Press, 1959. Pp. 274.
SUPER, D. E., & OVERSTREET, P. L. The Vocational Maturity of Ninth-Grade Boys. New York: Teachers College, Columbia Univ., 1960. Pp. 207.
TAYLOR, E. M. Psychological Appraisal of Children with Cerebral defects. Cambridge, Mass.: Harvard Univ. Press, 1959. Pp. 499.
TRASLER, G. In Place of Parents. New York: Humanities Press, 1960. Pp. 159.
VAN GENNEP, A. The Rites of Passage. Chicago: Univ. Chicago Press, 1960. Pp. 198.
WAELDER, R. Basic Theory of Psychoanalysis. New York: International Univ. Press, 1960. Pp. 273.
WARNER, W. L., & MARTIN, H. H., *Eds.* Industrial Man: Businessmen and Business Organizations. New York: Harper, 1959. Pp. 580.
WEINBERG, H. L. Levels of Knowing and Existence: Studies in General Somantics. New York: Harper, 1959. Pp. 274.
WEINBERG, S. K. Social Problems in Our Time: A Sociological Analysis. Englewood Cliffs, N.J.: Prentice-Hall, 1960. Pp. 600.
WESTWOOD, G. A Minority. London: Longmans, 1960. Pp. 216.
WHEELIS, A. The Seeker: New York: Random House, 1960. Pp. 242.
WILDEBLOOD, P. Against the Law: What it Means to be a Homosexual. New York: Julian Messner, 1959. Pp. 189.
WILL, R. B., *Ed.* John Dewey: Dictionary of Education. New York: Philosophical Library, 1959. Pp. 149.
WITTENBERG, R. M. Adolescence and Discipline: A Mental Hygiene Primer. New York: Association Press, 1959. Pp. 318.
WOLMAN, B. B. Contemporary Theories and Systems in Psychology. New York: Harper, 1960. Pp. 613.
WRIGHT, B. A. Physical Disability—A Psychological Approach. New York: Harper, 1960. Pp. 408.
ZELLER, E. A., *Ed.* Amino Oxidase Inhibitors. New York: New York Academy of Sciences, 1959. Pp. 551-1045.

Journal of Genetic Psychology

EDITED BY
CARL MURCHISON

Quarterly, published in March, June, September, and December. Devoted to child behavior, animal behavior, and the problems of aging. Manuscripts may be sent to any member of the Editorial Board, or may be sent directly to the general editorial office. All subscriptions and business communications should be sent directly to The Journal Press. Two volumes annually. Beginning with 1961, per annum, $20.00; per volume, $15.00; single numbers $7.50. Complete sets from 1891 at $15.00 per volume, plus transportation.

Journal of General Psychology

EDITED BY
CARL MURCHISON

Quarterly, published in January, April, July, and October. Devoted primarily to experimental, theoretical, clinical, and historical psychology. Manuscripts may be sent to any member of the Editorial Board, or may be sent directly to the general editorial office. All subscriptions and business communications should be sent directly to The Journal Press. Two volumes annually. Beginning with 1961, per annum, $20.00; per volume, $15.00; single numbers $7.50. Complete sets from 1927 at $15.00 per volume, plus transportation.

Journal of Social Psychology

EDITED BY
CARL MURCHISON

Bimonthly, published in February, April, June, August, October, and December. National, group, cultural, racial, and differential psychology. Manuscripts may be sent to any member of the Editorial Board, or may be sent directly to the general editorial office. All subscriptions and business communications should be sent directly to The Journal Press. Beginning with 1961, bimonthly, three volumes per year; per annum $30.00; per volume, $15.00; single numbers, $7.50. First number is dated February, 1930. Complete sets from 1930 at $15.00 per volume, plus transportation.

Each author will receive 100 unbound reprints gratis. Additional reprints may be purchased at a nominal cost when the author returns page-proof.

THE JOURNAL PRESS
2 Commercial Street
Provincetown, Massachusetts
U. S. A.

Club Rate For Five International Psychological Journals

(BEGINNING WITH 1961)

	PER ANNUM
THE JOURNAL OF GENETIC PSYCHOLOGY (Quarterly, two volumes per year)	$20.00
GENETIC PSYCHOLOGY MONOGRAPHS (Quarterly, two volumes per year)	$20.00
THE JOURNAL OF GENERAL PSYCHOLOGY (Quarterly, two volumes per year)	$20.00
THE JOURNAL OF SOCIAL PSYCHOLOGY (Bimonthly, three volumes per year)	$30.00
THE JOURNAL OF PSYCHOLOGY (Quarterly, two volumes per year)	$20.00
TOTAL	$110.00
TEACHERS AND STUDENTS EDITION, *Restricted Sale*	$30.00

The *Teachers and Students Edition* is open to any individual psychologist, teacher, student, or physician but requires an agreement that the edition will not be offered for sale till after five years from publication and an agreement that the edition will not be substituted for an institutional subscription.

The *"Small-Library" Edition* is discontinued.

THE JOURNAL PRESS

2 Commercial Street

Provincetown, Massachusetts

U. S. A.

Genetic Psychology Monographs

EDITED BY

CARL MURCHISON

Quarterly: February, May, August, November. Two volumes per year. Child behavior, animal behavior, and the problems of aging. Each number one or more complete researches. Manuscripts may be sent to any member of the Editorial Board, or may be sent directly to the general editorial office. All subscriptions and business communications should be sent directly to The Journal Press. Two volumes annually. Beginning with 1961, per annum, $20.00; per volume, $15.00; single numbers, $7.50. Complete sets from 1926 at $15.00 per volume, plus transportation.

NOTICE. Once more we offer free publication for certain selected monographs. Authors will be charged for cuts and expensive tables, but there will be no page charge for the first 50 pages. For all pages above 50 there will be a charge of $10.00 per page. Two hundred reprints of each monograph will be supplied free of charge, but there will be nominal charges for such things as vitas, special covers, or special title pages.

Genetic Psychology Monographs *(continued)*

VOLUME 1—1926

1. Performance tests for children of pre-school age—R. Stutsman
2. An experimental study of the eidetic type—H. Klüver
3 & 4. A study of natio-racial mental differences—N. D. M. Hirsch
5. A psychological study of juvenile delinquency by group methods—J. W. Bridges and K. M. B. Bridges
6. The influence of puberty praecox on mental growth—A. Gesell

VOLUME 2—1927

1 & 2. The mind of a gorilla—R. M. Yerkes
3. The role of eye-muscles in the expression of the emotions—K. Dunlap
4. Family similarities in mental-test abilities—R. H. Willoughby
5. Coördination in the locomotion of infants—L. H. Burnside
6. The mind of a gorilla: Part II. Mental development—R. M. Yerkes

VOLUME 3—January-June, 1928

1. An experimental study of the olfactory sensitivity of the white rat—J. R. Liggett
2. A photographic study of eye movements in reading formulae—M. A. Tinker
3. An experimental study of the East Kentucky mountaineers—N. D. M. Hirsch
4. Responses of foetal guinea pigs prematurely delivered—G. T. Avery
5. Objective differentiation between three groups in education (teachers, research workers, and administration)—M. B. Jensen
6. The effect of segregation on the sex behavior of the white rat as measured by the obstruction method—M. Jenkins

VOLUME 4—July-December, 1928

1. Observation and training in the fundamental habits in young children—E. A. Bott, W. E. Blatz, N. Chant, and H. Bott
2 & 3. Determination of a content of the course in literature of a suitable difficulty for junior and senior high school students—M. C. Burch
4 & 5. Methods for diagnosis and treatment of cases of reading disability—M. Monroe (*foreword by Samuel T. Orton*)
6. The relative effectiveness of lecture and individual reading as methods of college teaching—E. B. Greene

VOLUME 5—January-June, 1929

1. The age factor in animal learning: I. Rats in the problem box and the maze—C. P. Stone
2. The effect of delayed incentive on the hunger drive in the white rat—E. L. Hamilton
3. Which hand is the eye of the blind?—J. M. Smith
4. The effect of attitude on free word association-time—A. G. Ekdahl
5. The localization of tactual space: A study of average and constant errors under different types of localization—L. E. Cole
5. The effect of gonadectomy, vasotomy, and injection of placental and orchic extracts on the sex behavior of the white rat—H. Thomson

VOLUME 6—July-December, 1929

1. Learning and growth in identical infant twins: An experimental study by the method of co-twin control—A. Gesell and H. W. Nissen
2. The age factor in animal learning: II. Rats in a multiple light discrimination box and a difficult maze—C. P. Stone
3. The acquisition and interference of motor habits in young children—E. McGinnis
4. A vocational and socio-educational survey of graduates and non-graduates of small high schools of New England—A. D. Mueller
5 & 6. A study of the smiling and laughing of infants in the first year of life—R. W. Washburn

VOLUME 7—January-June, 1930

1. Tensions and emotional factors in reaction—E. Duffy
2. Teacher influence on class achievement: A study of the relationship of estimated teaching ability to pupil achievement in reading and arithmetic—H. R. Taylor
3 & 4. A study of the effect of inverted retinal stimulation upon spatially coördinated behavior—P. H. Ewert
5. Mental development of children with lesion of the central nervous system—E. Lord
6. An experimental study upon three hundred school children over a six-year period—N. D. M. Hirsch

VOLUME 8—July-December, 1930

1. The amount and nature of activities of newborn infants under constant external stimulating conditions during the first ten days of life—O. C. Irwin
2. Race and social differences in performance tests—S. D. Porteus, D. M. Dewey, and R. G. Bernreuter
3. Language and growth: The relative efficacy of early and deferred vocabulary training—L. C. Strayer
4. Eye-movements and optic nystagmus in early infancy—J. M. McGinnis
5 & 6. Reactions of kindergarten, first-, and second-grade children to constructive play materials—L. Farwell

VOLUME 9—January-June, 1931

1 & 2. The status of the first-born with a special reference to intelligence—H. H. Hsiao
3 & 4. An experimental study of bright, average and dull children at the four-year mental level—H. P. Davidson
5. An historical, critical, and experimental study of the Seashore-Kwalwasser test battery—P. R. Farnsworth
6. A comparison of difficulty and improvement in the learning of bright and dull children in reproducing a descriptive selection—F. T. Wilson

VOLUME 10—July-December, 1931

1. A comparative study of a group of southern white and negro infants—M. B. McGraw
2 & 3. An experimental study of prehension in infants by means of systematic cinema records—H. M. Halverson
4. The limits of learning ability in kittens—A. M. Shuey
5 & 6. The effect of habit interference upon performance in maze learning—O. W. Alm

VOLUME 11—January-June, 1932

1. General factors in transfer of training in the white rat—T. A. Jackson
2. The effect of color on visual apprehension and perception—M. A. Tinker
3. The reliability and validity of maze experiments with white rats—R. Leeper
4. A critical study of two lists of best books for children—F. K. Shuttleworth
5 & 6. Measuring human energy cost in industry: A general guide to the literature—R. M. Page

VOLUME 12—July-December, 1932

1. Family resemblances in verbal and numerical abilities—H. D. Carter
2. The development of fine prehension in infancy—B. M. Castner
3 & 4. The growth of adaptive behavior in infants: An experimental study at seven age levels—H. M. Richardson
5 & 6. Differential reactions to taste and temperature stimuli in newborn infants—K. Jensen

VOLUME 13—January-June, 1933

1. A critique of sublimation in males: A study of forty superior single men—W. S. Taylor
2. A study of the nature, measurement, and determination of hand preference—H. L. Koch, *et al.*
3. The growth and decline of intelligence—H. E. Jones and H. S. Conrad
4. The relation between the complexity of the habit to be acquired and the form of the learning curve in young children—M. L. Mattson
5. Eating habits in relation to personality developments in two-, and three-year-old children: A study of sixty-nine children in two nursery schools—A. A. Eliot
6. Coördinating mechanisms of the spinal cord—O. C. Ingebritsen

Genetic Psychology Monographs *(continued)*

VOLUME 14—July-December, 1933

1. Mental growth during the first three years: A developmental study of sixty-one children by repeated tests—N. Bayley
2. A study of triplets: including theories of their possible genetic relationships—F. N. Anderson and N. V. Schiedemann
3. The objective measurement of emotional reactions—H. V. Gaskill
4. Development of behavior in the fetal cat—J. D. Coronios
5. A study of certain language development of children in grades four to twelve, inclusive—L. L. LaBrant
6. The effect of early delayed practice in memory and motor performance studied by the method of co-twin control—J. R. Hilgrad

VOLUME 15—January-June, 1934

1. Studies in the psychology of tone and music—P. R. Farnsworth
2. Motor learning of children in equilibrium in relation to nutrition—E. L. Beebe
3. Discrimination limens of pattern and size in the goldfish *Carassius auratus*—J. B. Rowley
4. Limits of learning in the white rat and the guinea pig—E. F. Riess
5 & 6. The limits of learning ability in rhesus monkeys—H. A. Fjeld

VOLUME 16—July-December, 1934

1. A statistical study of ratings on the California behavior inventory for nursery school children—H. S. Conrad
2. An eye-movement study of objective examination questions—A. Frandsen
3. An experimental study of constitutional types—O. Klineberg, S. E. Asch, and H. Block
4. The development of a battery of objective group tests of manual laterality with the results of their application to 1,300 children—W. N. Durost
5 & 6. An experimental study in the prenatal guinea-pig of the origin and development of reflexes and patterns of behavior in relation to the stimulations of specific receptor areas during the period of active fetal life—L. Carmichael

VOLUME 17—January-December, 1935

1. Organization of behavior in the Albino rat—R. L. Thorndike
2. Brightness discrimination in the rhesus monkey—M. P. Crawford
3. The limits of learning ability in cebus monkeys—A. M. Koch
4. Nature-nurture and intelligence—A. M. Leahy
5. On intelligence of epileptic children—E. B. Sullivan and L. Gahagan
6. A study of the play of preschool children by an unobserved observer—D. L. Cockerel

VOLUME 18—January-December, 1936

1. Sex differences in ariational tendency—Q. McNemar and L. M. Terman
2. The process of learning to dress among nursery-school children—C. B. Key, M. R. White, A. B. Hieney, M. P. Honzik, and D. Erwin
3. A study of the present social status of a group of adults who, when they were in the elementary schools, were classified as mentally deficient—W. Baller
4. The influence of specific experience upon mental organizrtions—A. Anastasi
5 & 6. Studies in aggressiveness—L. Bender, S. Kriser, and P. Schilder

VOLUME 19—January-December, 1937

1. Psychological bases of self-mutilation—C. Dabrowski
   Masculine temperament and secondary sex characteristics: A study of the relationship between psychological and physical measures of masculinity—H. Gilkinson
2. A psychological study of forty unmarried mothers—R. D Nottingham
   Behavior problems in the children of psychotic and criminal parents—L. Bender
3. Domination and integration in the social behavior of young children in an experimental play situation—H. H. Anderson
4. The sequential patterning of prone progression in the human infant—L. B. Ames

VOLUME 20—January-December, 1938

1. The relationship between characteristics of personality and physique in adolescents—P. S. de Q. Cabot
2. Behavior problem of elementary school: A description and comparative study—I. Young-Masten
   Graphic representation of a man by four-year-old children in nine prescribed drawing situations—P. E. Gridley
3. Differences between two groups of adult criminals—R. S. Tolman
4. A comparative study by means of the Rorschach method of personality development in twenty pairs of identical twins—E. Troup
   Individual differences in the facial expressive behavior of pre-school children: A study by the time-sampling method—C. Swan

VOLUME 21—January-December, 1939

1. An experimental analysis of "level of aspiration"—R. Gould
2. Some light on the problem of bilingualism as found from a study of the progress in mastery of English among preschool children of non-American ancestry in Hawaii—M. E. Smith
3. Domination and social integration in the behavior of kindergarten children and teachers—H. H. Anderson
   The capacity of the rhesus and cebus monkey and the gibbon to acquire differential response to complex visual stimuli—W. E. Gault
4. The social-sex development of children—E. H. Campbell

VOLUME 22—January-December, 1940

1. Measuring human relations: An introduction to the study of the interaction of individuals—E. D. Chapple
2. Aggressive behavior in young children and children's attitude toward aggression—M. D. Fite
3. Student attitudes toward religion—E. Nelson
   The prediction of the outcome-on-furlough of dementia praecox patients—J. S. Jacob
   Significant characteristics of pre-school children as located in Conrad inventory—K. H. Read
4. Learning by children at noon-meal in a nursery school: Ten "good" eaters and ten "poor" eaters—J. B. McCay, E. B. Waring, and P. J. Kruse
   Studies in the interpretation of play: I. Clinical observation of play disruption in young children—E. H. Erikson

VOLUME 23—January-June, 1941

1. An analysis of certain variables in a developmental study of language—F. M. Young
   An analysis of the mental factors of various age groups from nine to sixty—B. Balinsky
2. Factors influencing performance on group and individual tests of intelligence: I. Rate of work—M. W. Bennett
   Individual differences in apperceptive reaction: A study of the response of preschool children to pictures—E. W. Amen

VOLUME 24—July-December, 1941

1. Twins *T* and *C* from infancy to adolescence. A biogenetic study of individual differences by the method of co-twin control—A. Gesell and H. Thompson
   Finger nail-biting: its incipiency, and amelioration—A. L. Billig
   An experimental study of the factors of maturation and practice in the behavioral development of the embryo of the frog. *Rana pipiens*—A. Fromme
2. The Fels child behavior scales—T. W. Richards and M. P. Simons
   Measurement of the size of general English vocabulary through the elementary grades and high school—M. K. Smith
   Stereotypes in the field of musical eminence—P. R. Farnsworth

VOLUME 25—January-June, 1942

1. A study of factors determining family size in a selected professioonal group—J. C. Flanagan
   A genetic study of geometrical-optical illusions—Sister A. Walters
   Interpretation of behavior-ratings in terms of favorable and unfavorable deviations: A study of scores from the Read-Conrad Behavior Inventory—K. H. Read and H. S. Conrad
2. Are there any innate behavior tendencies?—J. B. Schoolland
   An investigation of the intelligibility of the speech of the deaf—C. V. Hudgins and F. C. Numbers

Genetic Psychology Monographs *(continued)*

VOLUME 26—July-December, 1942

1. The critical frequency limen for visual flicker in children between the ages of 6 and 18—V. L. Miller
   Some factors determining handedness in the white rat—K. L. Wentworth
2. Motivation and behavior—E. Frenkel-Brunswik

VOLUME 27—January-June, 1943

1. Comparison of children's personality traits, attitudes, and intelligence with parental occupation—N. R. Maddy
2. A comparative study of mental functioning patterns of problem and non-problem children seven, eight, and nine years of age—M. L. Pignatelli

VOLUME 28—July-December, 1943

1. Separation anxiety in young children: A study of hospital cases—H. Edelston
2. Correlates of vocational preferences—W. A. Bradley, Jr.

VOLUME 29—January-June, 1944

1. Mental changes after bilateral prefrontal lobotomy—S. D. Porteus and R. D. Kepner
2. A twin-controlled experiment on the learning of auxiliary languages—B. Price, W. J. Kostir, and W. M. Taylor

VOLUME 30—July-December, 1944

1. A method of administering and evaluating the thematic apperception test in group situations—R. M. Clark
2. A study of anxiety reactions in young children by means of a projective technique—R. Temple and E. W. Amen

VOLUME 31—January-June, 1945

1. The evolution of intelligent behavior in rhesus monkeys—B. Weinstein
2. Perceptual behavior of brain-injured, mentally defective children: An experimental study by means of the Rorschach technique—H. Werner

VOLUME 32—July-December, 1945

1. A clinical study of sentiments: I.—H. A. Murray and C. D. Morgan
2. A clinical study of sentiments: II.—H. A. Murray and C. D. Morgan

VOLUME 33—January-June, 1946

1. Interpretation of spontaneous drawings and paintings—T. S. Wakhner
   Preference for sex symbols and their personality correlates—K. Franck
2. Outstanding traits in a selected college group—F. L. Wells and W. L. Woods

VOLUME 34—July-December, 1946

1. The relation of emotional adjustment to intellectual function—J. L. Despert and H. O. Pierce
   The smiling response—R. A. Spitz
2. Finger-painting and personality diagnosis—P. J. Napoli

VOLUME 35—January-June, 1947

1. The thematic apperception technique in the study of culture-personality relations—W. E. Henry
2. A continuation study of anxiety reactions in young children by means of a projective technique—M. Dorkey and E. W. Amen
   A study of the vocational interest trends of secondary school and college women—A. M. Cawley

VOLUME 36—July-December, 1947

1. Maze test validation and psychosurgery—S. D. Porteus and H. N. Peters
2. Diagnostic implications of Rorschach's Test in case studies of mental defectives—I. Jolles

VOLUME 37—January-June, 1948

1. The radio daytime serial: A symbolic analysis—W. L. Warner and W. E. Henry
   The relation of personality characteristics and response to verbal approval in a learning task—G. L. Grace
2. The mechanism of vision: XVIII. Effects of destroying the visual "associative areas" of the monkey—K. S. Lashley
   A study of the relationship between handwriting and personality variables—P. Castelnuova-Tedesco

VOLUME 38—July-December, 1948

1. Modern language learning: The intensive course as sponsored by the United States Army, and implications for the undergraduate course of study—M. Lind
   Conflict: A study of some interactions between appetite and aversion in the white rat—M. A. Tolcott
2. A study of certain formal psycho-social aspects of fantasy production in schizophrenia as revealed by performance on the Make a Picture Story (Maps) Test—E. S. Shneidman
   A study of the transmission of authority in the family—H. L. Ingersoll

VOLUME 39—January-June, 1949

1. A study of the psychoanalytic theory of psychosexual development—G. S. Blum
   The assessment of parental attitudes in relation to child adjustment—E. J. Shoben, Jr.
2. Qualitative differences in the vocabulary responses of normals and abnormals—H. Feivel
   The relative effectiveness of motion and still pictures as stimuli for eliciting fantasy stories about adolescent-parent relationship—P. E. Eisner
   The organization of heredity maze-brightness and maze-dullness—L. V. Searle

VOLUME 40—July-December, 1949

1. An experimental study of what young school children expect from their teachers—B. Biber and C. Lewis
   A study of the relative effects of age and of test difficulty upon factor patterns—H. A. Curtis
   A projective experiment using incomplete stories with multiple choice endings—J. K. Seaton
2. Effects of sex role and social status on the early adolescent personality—E. Milner
   Social perceptions and attitudes of children—M. Radke, H. Trager, and H. Davis

VOLUME 41—January-June, 1950

1. Some psychological and educational aspects of pediatric practice: A study of well-baby clinics—L. H. Blum
   One-trial learning in the domestic rat—B. B. Hudson
2. An introduction to the principles of scientific psychoanalysis—A. Ellis
   Awareness of racial differences by preschool children in Hawaii—D. V. Springer
   Children's evaluation of teacher-approved and teacher-disapproved behavior—S. L. Withyol
   The relationship between level of vocational aspiration and certain personal data—J. Stubbins

VOLUME 42—July-December, 1950

1. Personality patterns of suicidal mental hospital patients—N. L. Farberow
   Sex-role identification in young children in two diverse social groups—M. Rabban
2. A study of the influence of the social field on individual behavior: As revealed in the expression of hostility and warmth by neurotics and paranoid schizophrenics in discussion group situations—D. Shapiro
   An experimental study of avoidance—R. F. Hefferline

VOLUME 43—January-June, 1951

1. A study of copying ability in children—E. A. Townsend
   Prestige motivation of gifted children—D. P. Ausubel
2. A psychological study of physical scientists—A. Roe

VOLUME 44—July-December, 1951

1. The organization of hostility controls in various personality structures—S. Fisher and E. Hinds
   Children and radio: A study of listeners and non-listeners to various types of radio programs in terms of selected ability, attitude, and behavior measures—E. A. Ricciuti
2. Quantitative expression in young children—W. E. Martin
   The use of magnetic devices in the collection and analysis of the preverbal utterances of an infant—A.W. Lynip

VOLUME 45—January-June, 1952

1. Japanese-American personality and acculturation—W. Caudill
2. A statistical study of the Freudian theory of levels of psychosexual development—C. A. Barnes
   Personality characteristics of selected disability groups—D. N. Wiener

Genetic Psychology Monographs *(continued)*

VOLUME 46—July-December, 1952

1. The relationship of social status, intelligence, and sex of 10- and 11-year-old children to an awareness of poverty—F. J. Estvan
   An empirical study of the castration and Oedipus complexes—S. Friedman
2. The relationship between projective test scoring categories and activity preferences—M. M. Schwartz
   A comparison of formal and content factors in the diagnostic testing of schizophrenia—M. Sherman

VOLUME 47—January-June, 1953

1. Ability and accomplishment of persons earlier judged mentally deficient—D. C. Charles
   Variations in the consistency of the behavioral meaning of personality test scores—M. Kornreich
2. Some child-rearing antecedents of aggression and dependency in young children—R. R. Sears, *et al.*
   Symptom correlates for descriptive diagnosis—J. R. Wittenborn, *et al.*

VOLUME 48—July-December, 1953

1. Age and mental abilities: A longitudinal study—W. A. Owens, Jr.
   The development of a personality questionnaire for drinkers—P. J. Hampton
   Personality and physical disease: A test of the Dunbar hypothesis applied to diabetes mellitus and rheumatic fever—D. H. Crowell
2. Socio-economic contrasts in children's peer culture prestige values—B. Pope
   A critical review of the stability of social acceptability scores obtained with the partial-rank-order and the paired-comparison scales—S. A. Witryol and G. G. Thompson
   A study of the effects of color in Rorschach response—C. G. Brody

VOLUME 49—January-June, 1954

1. Factors underlying major reading disabilities at the college level—J. A. Holmes
   Parent behavior toward first and second children—J. K. Lasko
2. Social-status and intelligence: An experimental study of certain cultural determinants of measured intelligence—E. A. Haggard
   Certain determinants and correlates of authoritarianism—S. Siegel
   Personalities in faces: I. An experiment in social perceiving—P. F. Secord, W. F. Dukes and W. Bevan

VOLUME 50—July-December, 1954

1. A study of the relationship between play patterns and anxiety in young children—E. W. Amen and N. Renison
   Operational explorations of the conceptual self system and of the interaction between frames of reference—M. Edelson and A. E. Jones
   Problem solving: A statistical description of some relationships between organismic factors and selected response measures—N. A. Fattu, E. Kapos and E. V. Mech
2. The relation of cortical potentials to perceptual functions—C. Chyatte
   The import for clinical psychology of the use of tests devised from theories about infantile sexuality and adult character—D. W. Miles
   Measuring personality in developmental terms: The P.P.S.—M. H. Krout and J. K. Tabin

VOLUME 51—January-June, 1955

1. Some relations between techniques of feeding and training during infancy and certain behavior in childhood—A. Bernstein
   The expression of personality in drawings and paintings—L. H. Stewart
2. Negative stereotypes concerning Americans among American-born children receiving various types of minority-group education—J. A. Fishman
   The Lincoln-Oseretsky motor development scale—W. Sloan

VOLUME 52—July-December, 1955

1. Some personality correlates of sex, sibling position, and sex of sibling among five- and six-year-old children—H. L. Koch
   A quantitative Rorschach assessment of maladjustment and rigidity in acculturating Japanese Americans—G. Devos
   Measurement of authoritarianism and its relation to teachers' classroom behavior—H. M. McGee
2. The formal aspects of schizophrenic verbal communication—B. Mirin
   A study in an aspect of concept formation with subnormal, average, and superior adolescents—H. N. Hoffman
   Traumatic avoidance learning: Acquisition and extinction in dogs deprived of normal peripheral autonomic function—L. C. Wynne and R. L. Solomon

VOLUME 53—January-June, 1956

1. As the psychiatric aide sees his work and problems—F. L. Wells, M. Greenblatt and R. W. Hyde
   An investigation of avoidance, anxiety, and escape behavior in human subjects as measured by action potentials in muscle—J. D. Brothers
   Spread of effect: A critical review—M. H. Marx
2. Stress, fantasy, and schizophrenia: A study of the adaptive processes—O. J. B. Kebner
   The attitude structure of the individual: A Q-study of the educational attitudes of professors and laymen—F. N. Kerlinger

VOLUME 54—July-December, 1956

1. A study of the personality differences between middle and lower class adolescents: The Szondi Test in culture-personality research—L. Rainwater
   The assessment of parental identification—S. W. Gray and R. Klaus
2. The influence of social context on impulse and control tendencies in preadolescents—G. H. Zuk
   Tender-mindedness versus tough-mindedness in psychology: A reexamination—H. Winthrop
   A method for the comparison of groups: A study in thematic apperception—L. C. Shaw and W. E. Henry

VOLUME 55—January-June, 1957

1. Academic performance and personality adjustments of highly intelligent college students—B. M. Horrall
   The use of the Vineland Social Maturity Scale in the planning of an educational program for non-institutionalized low-grade mentally deficient children—M. G. Gottsegen
2. The structure and origin of the anal character—H. Beloff
   Free expression of adolescents' interests—M. Amatora
   The role of mass media and the effect of aggressive film content upon children's aggressive responses and identification choices—R. S. Albert
   Interest in persons as an aspect of sex difference in the early years—E. W. Goodenough

VOLUME 56—July-December, 1957

1. Some stable response determinants of perception, thinking, and learning: A study based on the analysis of a single test—M. L. Simmel and S. Counts
   Potentials of age: An exploratory field study—S. L. Pressey
2. Tactile communication—L. K. Frank
   The use of a filmed puppet show as a group projective technique for children—M. R. Haworth
   The social competence of middle-aged people—R. J. Havighurst

VOLUME 57—January-June, 1958

1. Psychological and cultural problems in mental subnormality: A review of research—S. B. Sarason and T. Gladwin
2. Developmental aspects of discrimination in relation to adjustment—P. London
   Muscular tension as a response to psychological stress in rheumatoid arthritis and peptic ulcer—J. A. Southworth
   Frustration: Theory and experiment—R. Lawson and M. H. Marx

VOLUME 58—July-December, 1958

1. Emotional aspects of political behavior: The woman voter—E. M. Bennett and H. W. Goodwin
   The accuracy of self estimate: A measure of self-concept reality—R. M. Brandt
   Personality factors in social mobility: A study of occupationally mobile businessmen—J. C. Abegglen
2. Interaction between authoritarian and nonauthoritarian principals and teachers—P. Lambert
   Some factors related to the choice-status of ninety eighth-grade children in a school society—D. Elkins
   Some relationships between fantasy and self-report behavior—R. G. Calogeras

Genetic Psychology Monographs *(continued)*

VOLUME 59—January-June, 1959

1. Freshman Rorschachs and college performance—G. R. Schmeidler, M. J. Nelson, and M. Bristol
   Perceptual aspects of attributed movement—R. W. Coan
   Men and women: Personality patterns and contrasts—E. M. Bennett and L. R. Cohen
2. Personality factors in mothers of cerebral palsied children—G. Boles
   Separatism and integrationism: A social-psychological analysis of editorial content in New York newspapers of three American minority groups—J. A. Fishman and G. S. Fishman
   Self, role, and satisfaction—A. L. Brophy

VOLUME 60—July-December, 1959

1. The constancy of personality ratings over two decades—R. D. Tuddenham
   Mother-son identification and vocational interest—L. H. Stewart
   A study of mother-child relationships in the emotional disorders of children—M. J. Rosenthal, M. Finkelstein, E. Ni, and R. E. Robertson
   On the trail of the wolf-children—W. F. Ogburn and N. K. Bose
2. Measuring the mental health of normal adults—R. F. Peck
   Parental identification in young children—W. Emmerich
   The problems of Jewish religious youth—B. M. Levinson

VOLUME 61—January-June, 1960

1. Identifying socially maladjusted school children—A. A. Adams
   Social interaction in an interracial nursery school—H. W. Stevenson and N. G. Stevenson
   Interests of pre-adolescent boys and girls—M. Amatora
   Educational and sex differences in the organization of abilities in technical and academic students in Colombia, South America—J. F. Filella
2. Some themes in the personalities of German men—L. Rainwater
   Right-left gradients in body image, body reactivity, and perception—S. Fisher
   Longitudinal survey of child Rorschach responses: Younger subjects two to 10 years—L. B. Ames
   Personality patterns related to occupational roles—M. Siegelman and R. F. Peck

VOLUME 62—July-December, 1960

1. The reading process: A descriptive, interdisciplinary approach—M. P. Langman
   Reactions to stress as a function of the level of intelligence—S. M. H. Zaidi
   Rorschach diagnosis by a systematic combining of content, thought process, and determinant scales—P. A. Bower, R. Testin, and A. Roberts
   Longitudinal survey of child Rorschach responses: Older subjects aged 10 to 16 years—L. B. Ames
2. Twenty years of shock therapy in America, 1937-1956: An annotated bibliography—N. H. Pronko, R. Sitterly, and K. Berg
   The quantitative analysis of parent behavior toward psychotic children and their siblings—E. M. Donnelly

VOLUME 63—January-June, 1961

1. Make a sentence test: An approach to objective scoring of sentence completions—E. F. Borgatta
   Some aspects of the relationship between perception and motility in children—E. P. Rothman
   Some psychophysical aspects of mental illness in children—P. H. Berkowitz
   Conceptual thinking in schizophrenic children—G. Friedman
2. Some maternal influences on children's personality and character—J. C. Finney
   A study of concept formation in normals, mental defectives, and brain-damaged adults—R. W. Zaslow
   An investigation of trait relationships among six-year-old children—S. A. Avakian

THE JOURNAL PRESS
2 Commercial Street
Provincetown, Massachusetts
U. S. A.

$20.00 per year
$15.00 per volume
Single Numbers $7.50

QUARTERLY
Two volumes per year

June, 1961
Volume 98, Second Half

Founded by G. Stanley Hall in 1891, reorganized by Carl Murchison in 1925

THE JOURNAL OF GENETIC PSYCHOLOGY

Child Behavior, Animal Behavior, and Problems of Aging

If this space should be unstamped, this is the regular library edition. But if this space is stamped with a designating title, this is a special edition, sold under the restrictions of a liberal contract, and may not be resold for a period of five years from the date of publication.

JUNE, 1961

(Manuscripts are printed in the order of final acceptance)

The delayed field drive in the raccoon and cat 161
By Willard E. Caldwell and Minnie Rob Phaup

Stimulus determinants of aggregative behavior in the domestic chicken . . 177
By Alan Baron, George B. Kish, and Joseph J. Antonitis

Stimulus and reward displays in discrimination learning 183
By A. J. Riopelle and Harry F. Harlow

Impulsivity and sex preference 187
By B. Sutton-Smith and B. G. Rosenberg

An analysis of factors related to educational achievement 193
By Rachel S. Sutton

Effects of CS-US interval on avoidance conditioning of cats 203
By Allan M. Schrier

(over)

Copyright, 1961, by The Journal Press
Provincetown, Massachusetts, U. S. A.

Entered as second-class matter May 11, 1937, at the post-office at Provincetown, Mass., under the Act of March 3, 1879
Second-class postage paid at Provincetown, Mass.

The effect of socially learned aggression or submission on the mating behavior of C57 mice 211
By Marvin W. Kahn

Children's discovery of the conservation of mass, weight, and volume: Piaget Replication Study II 219
By David Elkind

An investigation of auditory figure-ground perception 229
By Louis Lerea

The responsiveness of rhesus monkeys to motion pictures 239
By Robert A. Butler

Differential study of recidivism among negro and white boys 247
By Comradge L. Henton and Charles Washington

The effect of socio-economic and emotional factors on the onset of menarche among negro and white girls 255
By Comradge L. Henton

Questionnaire items and types of intelligence 265
By William D. Altus

Preliminary observations on play behavior in puppies 273
By William T. James

A developmental study of judgments of semantic similarity 279
By John H. Flavell and Donald J. Stedman

Reliability of three infant developmental scales administered during the first year of life 295
By Damaris Pease, Josephine Keefe Rosauer, and Leroy Wolins

SHORT ARTICLES AND NOTES 299

Intellective and non-intellective factors in a classroom test (William D. Altus) 299

Correlative data for first-semester grade averages at the University of California, Santa Barbara (William D. Altus) 303

A multiple-alley straightaway for latency and speed measures (William Bevan and Robert Adamson) 307

BOOKS 311

BOOKS RECENTLY PUBLISHED 311

The Journal of Genetic Psychology, 1961, 98, 161-175.

THE DELAYED FIELD DRIVE IN THE RACCOON AND CAT*

Department of Psychology, The George Washington University

WILLARD E. CALDWELL AND MINNIE ROB PHAUP

A. PROBLEM

The use of extereoceptive motivation in experiments with animals (4) is of increasing interest to psychologists. In the present study, light is used as motivation and darkness as reward in a delayed reaction experiment with raccoons and cats as subjects. This investigation is a continuation of a series performed by Caldwell and associates (1, 2, 3), in which a variety of external stimuli were employed in maze and discrimination problems. In the present paper emphasis is placed on investigation of delayed response when such external stimuli are used.

In an age when perceptrons and mechanical mice seem sometimes to outrun their progenitors, studies of both human and animal learning assume new significances and provoke questions hitherto unasked.

B. METHOD

1. *Subjects*

The subjects were two male raccoons, each approximately eight weeks old, two male cats and one female cat each one year of age or older. Though more conclusive results might be obtained from using a larger number of animals, the experimenters feel that procedures followed and results obtained with the admittedly small number used are provocative for future experimentation. The animals were housed in a laboratory basement where the temperature was kept fairly constant by means of an exhaust fan. The raccoons lived in separate monkey cages and the cats in one large cage. Food consisting of frankfurters, white and brown bread, lettuce and milk, was kept in the cages along with a sufficient supply of water; but care was taken not to place fresh food or water in the cages immediately before the experiment or just subsequent to it in order to eliminate the possibility that hunger or thirst reduction might serve as reinforcement or as "backward reinforcement." The animals were carried to the experiment in a transport box and also were placed in the transport box during the cleaning of the cages.

* Received in the Editorial Office on June 17, 1959.

2. *Apparatus*

The apparatus consisted of a large plywood box divided into three major parts: the adaptation compartment, the choice compartment, and the goal compartments.

The adaptation compartment, by which the animal entered the apparatus, was two feet long by two feet wide; its top, on which there was a six inch

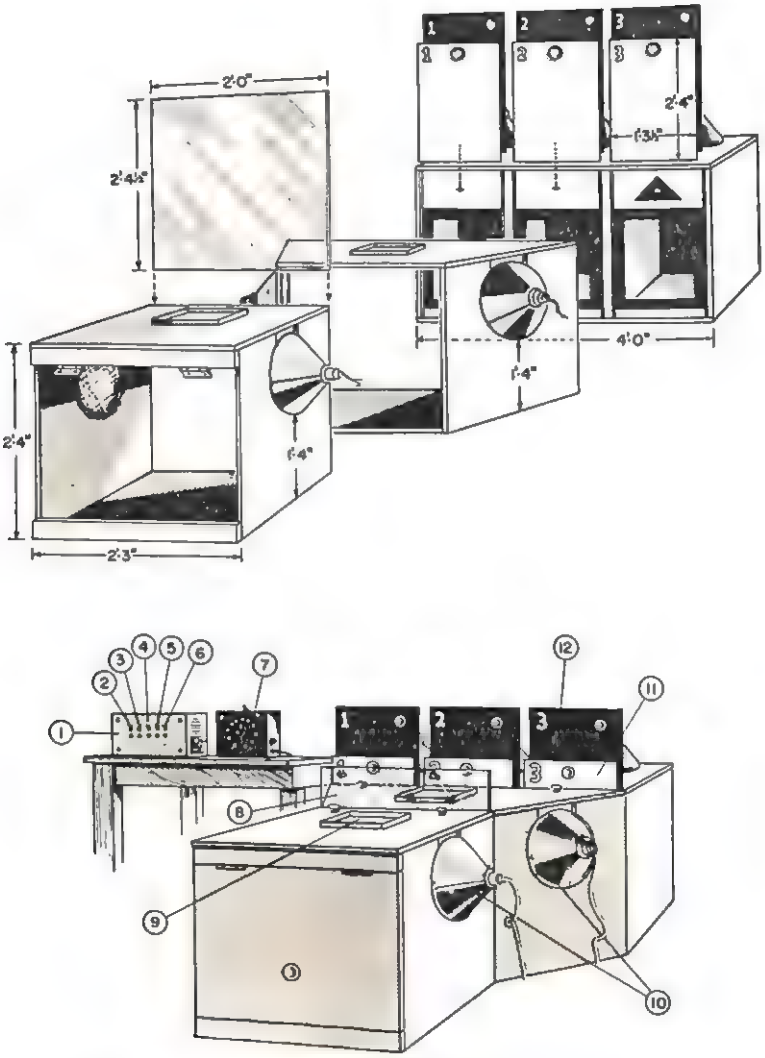


FIGURE 1
TWO VIEWS OF THE APPARATUS USED IN THE EXPERIMENT

by four and one-half inch one way vision screen, could be opened and closed. A transparent plastic sliding door two feet four inches by two feet divided the adaptation from the choice compartment.

The choice compartment was considerably larger than the adaptation compartment, the sides extending on either side so that all three goal compartments could be joined to it. On its movable top was a one way vision screen of the same dimensions as the one on the adaptation compartment. The sides of the choice compartment were two feet long and two feet high, the width of the whole compartment at the front being four feet and at the back only two feet three inches.

When in the choice compartment the animal faced the three goal compartments, each of which contained two sliding doors that extended up to the outside of the apparatus and could be raised or lowered by the experimenter. The first door was painted white as were two others, and had a one foot wide three and a half inches high rectangular opening in the center of it. The opening was edged with a one inch strip of black paint. One inch above the rectangle was a black triangle four inches high and five and one-half inches wide. The three white doors had triangles and rectangles on one side and only rectangles on the other. This permitted the experimenter to rotate the position of the triangle with respect to the rectangle by turning the doors. The second door in each goal compartment was black and was two feet, 11 inches high and one foot three and one-half inches wide. These black doors could be raised above the animal's line of vision when he was in the choice box.

Both the adaptation and the choice compartments were equipped with four flood lights in cone reflectors located on the outside of the apparatus. The openings through which the lights illuminated the inside of these compartments were covered with white wire screen which prevented the animals from coming in contact with the light bulbs. Two of the reflectors were placed one foot and four inches from the floor on opposite sides of the adaptation compartment and two at the same height on opposite sides of the choice compartment. There was a floodlight in a cone reflector over each of the three goal compartments; and when the animal entered the wrong compartment, the experimenter could administer punishment by turning on the light. The inside of the apparatus was painted with white oil paint to reflect as much of the light as possible.

All of the floodlights were connected to a central switch box and governed by five silent switches. One switch controlled all the floodlights in the choice and adaptation compartments; there was a switch for each goal compartment,

and one for the electric timer. The use of Mercury silent switches for the lights and of rubber mats around the apparatus to silence the tread of the experimenter cut down noise variables. Some of the visual variables were controlled by the one-way vision mirrors which allowed the experimenter to look in and see the animals without being seen by them. To permit this the experiment had to be done in a dark room; therefore numbers on the clock and on all of the various doors had to be luminous.

Two thermometers on the inside and one on the outside of the apparatus measured the temperature which was kept down by various slots in the apparatus allowing the air in and by opening the top doors in between trials to insure cooling. Before the experiment started the animals were allowed a period of dark adaptation which served to intensify the light for the animals without increasing heat in the apparatus.

A Weston Master II, Universal Exposure Meter, Model 735 (Weston Elec. Inst. Corp.) was placed in various positions in the adaptation and choice compartments to measure the light; the average reading was 35 foot-candles. When the doors to the unlighted goal compartments were opened, the amount of light reflected into these compartments from the lighted choice and adaptation compartments averaged .4 foot-candles. When the lights were on in the goal compartments, the average was 35 foot-candles; but when the lights were off and the black sliding doors lowered, the readings were less than .2 foot-candles.

3. *Procedure*

In Part I of this experiment Trials 1—15 were run on all five of the animals. The animals were carried in the transport box and allowed to enter the totally dark adaptation compartment, where they remained for five minutes in order to permit them to recover from being carried in the transport box and from the shock of a new environment as well as to allow dark adaptation and thus increase intensity of motivation in the choice box.

At the end of five minutes, the floodlights in the adaptation and the choice compartments were turned on and the plastic door was raised. The animal was given 10 minutes in which to enter the correct goal compartment—always the one with the triangle over the rectangular door. All three of the goal compartments were opened, the amount of light reflected from them being .4 foot-candles, while that in the choice and adaptation compartments was 35 foot-candles.

If the animal entered an incorrect goal compartment, the light was turned to 35 foot-candles to act as punishment, and an error was recorded. Usually

the animal left the goal compartment when the light was turned on; but if it had not done so after one minute, the experimenter would gently push it back into the choice compartment. If the animal had not entered the correct goal compartment within the 10 minute time limit, the experimenter carefully shoved it into the correct goal compartment and allowed it to remain there in the dark for five minutes. Whenever the animal entered the correct goal box—either through its own volition or the experimenter's urging—it was allowed to remain there for five minutes in light intensity of slightly less than .4 foot-candles. At the end of the five minutes' reinforcement, the experimenter turned the lights on in the laboratory, placed the transport box against the open back door of the goal box, and waited for the animal to crawl into it. The animal was then transported back to its cage and allowed to crawl into that.

In order to avoid the animal's learning only a position habit, the triangle was rotated over the doors as follows: 1, 3, 2, 1, 3, 2; then 1, 2, 3, 1, 2, 3 and then the sequence would be repeated. In previous experiments of this kind, the experimenters had used a statistically random order but observed that it might not be random from the frame of reference of the animal. Total errors for each trial were recorded as well as length of time required for each correct choice.

Part II, the delayed training period, also used all five animals. Each animal was trained to wait in the dark adaptation box for one minute after it had been exposed to the triangle. After the one-minute period, the animal solved the problem as in Part I. Because the sudden introduction of the delay might be traumatic and this might interfere with the animal's demonstrating its actual ability to solve the problem, the training period before the animal was subjected to the actual delayed test was utilized. In the interest of economy of operation, time limits were imposed on the animal as follows: one minute in the adaptation compartment with lights out, one minute in the light to look at the triangle, one minute in the dark adaptation compartment, four minutes to make the correct response in the choice compartment, and one minute in the dark goal box. Trials 16 through 20 comprised Part II of the experiment.

In Part III, the delayed test, the procedure was the same as that in Part II except that after the animal had seen the triangle and was waiting in the dark for one minute, the experimenter reversed the door of the correct goal compartment so that the triangle was removed. Then the animal was allowed to enter the choice compartment where it had to choose the door over which the triangle had been.

Part IV used only the raccoons and followed the same procedure as that for Part III with the exception that the time allowed the animal to make the correct choice was increased to 30 minutes. This was necessitated by the fact that raccoon No. 2 crawled very slowly to the goal box; however, the increase gave the experimenter the opportunity to test longer periods of delay, since one of the measures was the total amount of time it took the animal to enter the goal box. Trials 25 to 34 were training trials and 35 to 44 were delayed tests.

Part V, in which the procedure was a continuation of that instituted in Part III, was applied to the cats only. Trials 25 to 29 were delayed training periods and 30 to 34 delayed tests. At this point because of the poor and unpromising performance of the cats, this technique with them was discontinued.

Part VI consisted of a conflict procedure applied to cat No. 3 who had previously shown interesting responses. The animal was subjected to eight trials involving conflict in which the order of the triangles was switched and the reinforcement reversed to make the total field as motivationally ambiguous as possible. In the first trial, the cat was simultaneously presented with three triangles, one above each rectangular door. The animal was allowed to look at them for one minute, then to wait in the dark for one minute, and then to face all three triangles from the choice compartment. One minute of reinforcement in the dark was given the cat in any one of the goal compartments it entered.

In Trial 2 the same procedure as in Trial 1 was followed except that the floodlights were turned on when the cat entered a goal compartment.

In Trial 3 all of the triangles were removed in the period before delay in the choice compartment. Also the goal box was dark.

In Trial 4 the procedure was similar except that the floodlight was turned on in the goal compartment the animal entered and the door closed behind him.

Trial 5 did not permit the cat to see any triangle in the one minute before the delay, but it did see the triangles from the choice compartment. This time the goal box was dark.

Trial 6 followed the procedure used in Trial 5, but the floodlights were turned on in the goal compartment.

Trial 7 permitted the animal to see the three triangles in the period before delay but not during the time in the choice compartment. In this trial the goal box was dark.

Trial 8 utilized the same procedure as that of Trial 7 with the exception

that the floodlights were turned on in the goal compartment the animal choose.

In all of the trials the animal could enter any one of the compartments; but if it did not do so within the four-minute time limit, the experimenter shoved it into one of them.

Throughout all of the above procedures both objective data (time and errors) and qualitative observations were recorded. Daily recordings of temperature in the apparatus and in the laboratory showed the reading in the apparatus to be approximately five degrees higher than that in the laboratory. However, within the apparatus there was little difference in temperature from one compartment to another.

C. Results

The raw data for Parts I, II, III, IV, and V of this experiment will be presented in Tables 1, 2, 3, and 4. This will be followed by a statistical analysis.

Table 1 shows the time and error data for Part I of the experiment in which, as stated above, all of the animals were run for 15 trials, the procedure consisting of five minutes in the adaptation box, 10 minutes in the choice compartment, and five minutes in the dark goal compartment. The first row of the table gives the trial and the second row the number of the compartment containing the triangle over the rectangle.

In Parts II and III, the animals were subjected to the delayed training schedule, and the time for all parts of the experiment was reduced.

TABLE 1

Part I of the Experiment Time[a] and Errors for Raccoons and Cats in Trials 1-15

Trial	Door	Raccoon 1		Raccoon 2		Cat 1		Cat 2		Cat 3	
		Time	Errors	Time	Errors	Time	Errors	Time	Errors	Time	Errors
1	1	281	0	600	0	103	1	5	0	330	1
2	3	161	0	30	0	60	1	4	0	252	0
3	2	600	4	5	0	352	1	293	2	30	0
4	1	201	1	4	0	600	2	309	3	90	0
5	3	64	2	418	1	90	0	600	0	600	3
6	2	180	4	27	0	600	1	600	2	600	0
7	1	90	1	443	3	112	0	600	2	600	0
8	2	94	4	5	0	600	3	600	0	531	2
9	3	95	1	3	0	600	2	600	1	45	0
10	1	320	6	117	1	5	0	600	1	337	5
11	2	280	5	118	1	600	3	600	3	600	3
12	3	80	0	290	2	155	1	600	1	190	3
13	1	217	6	600	3	15	0	600	3	600	2
14	2	15	0	150	1	600	6	15	0	12	0
15	3	20	1	280	2	600	0	330	2	600	2

[a] In seconds.

Part III consisted of the actual delayed test, where the experimenter removed the triangle. Table 2 presents the data from Parts II and III.

TABLE 2

PART II, THE DELAYED TRAINING, TRIALS 16-20, AND PART III, THE DELAYED TEST, TRIALS 21-24, TIME[a] AND ERRORS FOR RACCOONS AND CATS

Trial	Door	Raccoon 1 Time	Raccoon 1 Errors	Raccoon 2 Time	Raccoon 2 Errors	Cat 1 Time	Cat 1 Errors	Cat 2 Time	Cat 2 Errors	Cat 3 Time	Cat 3 Errors
					The delayed training period						
16	1	140	3	120	0	240	1	240	1	240	1
17	1	3	0	30	0	240	0	240	1	240	1
18	2	173	3	240	0	191	2	240	1	240	1
19	3	128	2	240	0	240	0	30	0	30	0
20	1	3	0	240	3	20	0	240	2	120	0
					The delayed test						
21	2	120	2	240	0	240	0	240	1	240	0
22	3	112	0	240	0	80	1	30	0	240	2
23	1	135	0	240	1	240	0	240	0	240	0
24	2	50	1	240	0	240	2	240	0	240	0

[a] In seconds.

Table 3 contains data for Part IV, where only the raccoons were subjected to 10 additional training trials and 10 delayed tests.

TABLE 3

PART IV OF THE EXPERIMENT TIME[a] AND ERRORS FOR RACCOONS IN THE DELAYED TRAINING PERIOD, TRIALS 25-34, AND IN THE DELAYED TEST, TRIALS 35-44

Trial	Door	Raccoon 1 Time	Raccoon 1 Errors	Raccoon 2 Time	Raccoon 2 Errors	Trial	Door	Raccoon 1 Time	Raccoon 1 Errors	Raccoon 2 Time	Raccoon 2 Errors
		The delayed training period						*The delayed test*			
25	1	67	0	60	0	35	2	300	2	1800	1
26	3	90	5	360	2	36	3	15	0	800	3
27	2	100	4	1525	6	37	2	3	0	420	0
28	1	180	0	1800	6	38	3	45	0	1200	0
29	3	15	0	1200	5	39	1	3	0	165	0
30	2	47	1	780	1	40	2	2	0	1800	0
31	1	30	0	1800	0	41	3	60	0	900	0
32	2	105	2	1800	0	42	1	210	1	1800	1
33	3	35	1	1800	0	43	1	2	8	1020	8
34	1	10	1	1800	0	44	3	75	0	420	0

[a] In seconds.

In Table 4 are the data for Part V of the experiment, which applies to the cats alone, who, because of their poor performance were run for only 10 more trials. Trials 25-29 inclusive were training periods and 30-34 were actual delayed tests.

A truncation analysis of the raccoons and cats was made for the first 24

trials (Tables 1 and 2, Parts I, II, and III), where both raccoons and cats were employed under the same control conditions. When the truncations for raccoons were compared with the truncations for cats, the following data were obtained. Both raccoons and cats were truncated 51 times; 9 times for raccoons and 42 for cats. The raccoons and cats were not truncated 69 times; 39 non-truncated trials were of raccoons and 30 of cats. When the numbers of truncated and non-truncated trials were totaled, there were 48 for the raccoons and 72 for the cats, a total of 120 trials. Analysis by the 2×2 contingency chi-square showed that the observed proportions for truncations were significantly different for the cats and raccoons at better than the .001 level.

TABLE 4

PART V OF THE EXPERIMENT TIME[a] AND ERRORS FOR CATS IN THE DELAYED TRAINING PERIOD, TRIALS 25-29, AND IN THE DELAYED TEST, TRIALS 35-44

Trial	Door	Cat 1		Cat 2		Cat 3	
		Time	Errors	Time	Errors	Time	Errors
			The delayed training period				
25	3	240	0	140	2	75	0
26	1	240	0	140	2	60	0
27	1	240	0	140	0	240	1
28	2	240	0	240	0	70	1
29	3	240	1	240	0	240	1
			The delayed test				
30	1	240	1	240	0	40	0
31	2	240	0	240	0	40	0
32	3	90	1	240	0	240	0
33	2	240	0	240	0	240	0
34	3	240	0	240	0	240	0

[a] In seconds.

A truncation analysis was made for the two raccoons for the entire series of 44 trials (Tables 1, 2, and 3; Parts I, II, III, and IV). Raccoons 1 and 2 were truncated a total of 17 times, of which Raccoon 1 was truncated one time and Raccoon 2 16 times. Raccoon 1 was not truncated 43 times and Raccoon 2 not truncated 28 times. The total of truncated and non-truncated times for each raccoon was 44 or 88 for the two. Because of the single observation in one cell, the chi-square test was deemed inappropriate and Fisher's exact probabilities were computed under the hypothesis that the two raccoons were similar in their probability of selecting the goal box during the series of trials. The resultant probabilities indicate that there are less than four chances in 100,000 that the two raccoons have a similar likelihood of selecting the goal box correctly.

An analysis was made of the error distribution for the two raccoons for

Trials 1-15, 16-24, and 25-44 (Parts I, II, III, and IV). In all cases the distributions of numbers of errors were similar. Furthermore, there did not seem to be any relationship between number of errors and length of trial period. This implies that the truncation time may not be as serious as it appears on the surface.

An analysis was made of the time distribution for the raccoons and cats for all parts of the experiment. Frequency distributions were constructed for each animal to note how the length of time was distributed. It is evident that the animals are so different that no tentative decision can be made about length of time to make a decision. Also, the truncation process makes some of the times meaningless.

Error rates per unit of time were studied for the two raccoons, since neither the number of errors nor the time involved in the trials provided useful results. Raccoon 1 seemed to have a greater tendency to make errors than did Raccoon 2, yet he eventually found the correct goal box. Raccoon 2 was more sluggish and tended to commit fewer errors per minute, yet he needed to be pushed into the goal box more often.

Error rates versus trial time for the two raccoons were examined. It was felt that the number of errors per minute might be a function of the length of time involved. The plots for the raccoons were extremely different, yet neither tended to indicate that error rates were related to time.

An analysis was made of the number of times the raccoons and cats selected the correct goal for all parts of the experiment. Both raccoons were run a total of 44 trials. Raccoon 1 entered 43 times and did not enter one time. Raccoon 2 entered 27 times and did not enter 17. The cats were run for a total of 34 trials. Cat 1 entered 12 times and did not enter 22. Cat 2 entered 11 times and did not enter 23. Cat 3 entered 15 and did not enter 19. A chi-square analysis was run to test the hypothesis that the five animals possessed the same likelihood of eventually entering the correct goal box during the allotted time periods. The resultant analysis showed that there is less than one chance in 1,000 that the five animals have similar probabilities. Further, both raccoons are well above the cats in their tendencies to select the goal box during the sequences of trials. In all cases, based upon experimental evidence, the likelihood of entering the correct goal box could exceed 1/3. This would imply that all five animals could, using confidence limit estimates for their true likelihood, conceivably have made better than a chance selection in the entire series of trials.

An analysis was made of the last 10 trials in Table 3, which was the crucial part of the experiment for the raccoons, since it was their final delayed

test. Raccoon 1 completed Trials 36 through 41 with no errors, seven of the 10 delayed tests being made under the time limit with 100 per cent accuracy. Raccoon 2 successfully completed Trials 37 through 41 consecutively and Trial 44, passing six out of the 10 delayed tests. The probability of no mistakes in n trials is $(1/3)^n$. The probability of no mistakes x times in a row is $(1/3)^x$. There were only three choices. If the animal made the correct response three times in a row, with no mistakes, this is significant at the 5 per cent level; if it made five choices consecutively with no mistakes, this is significant at the one per cent level.

Only Cat 3 was selected for Part VI, the conflict situation, because (*a*) it manifested a peculiar type of muscular rigidity whenever the experimenter tried to move it into or out of the goal compartment, (*b*) it showed signs of perseveration in that it made the same error over and over again. When this animal was subjected to the eight different conflict situations, there was a decided magnification of the patterns of behavior which had previously appeared in the experiment. The rigidity was more pronounced, goal perseveration increased, the cat offered great resistance to being shoved out of the goal box and repeatedly reentered the same box. This behavior was frequently followed by a period when the animal lay down and after the four minute time limit rigidly resisted being pushed into the goal compartment. As soon as the cat was taken out of the apparatus and placed on the floor, it returned to its previous state of muscular flexibility.

D. Discussion

It should be noted that the general purpose of this experiment was to test the adaptability of these two species to the particular combination of the delayed reaction test with extereoceptive motivation. The objective was not the comparison of the raccoon and the cat. For one thing, the sample was too small to make such a comparison as would apply to raccoons and cats in general. Any differences that appeared should be confined to the particular animals selected in this study.

The cats did not show up as well as did the raccoons. The decision to stop working on them was due to practical considerations. In general, cats take considerably more time and trials to learn such a problem; and Part I could have been extended much longer until the cats had learned this part of the problems. The cats showed a tendency to increase in the length of time that it took them to get to the goal box. It could be that these time scores suggest increasing resistance, with successive trials, to perform in the ap-

paratus. This resistance hypothesis itself is an interesting hypothesis and may merit further study and analysis.

Marked individual differences among both raccoons and cats and between the two species were in evidence throughout the experiment. Raccoon 1 was characteristically active, running almost immediately from the choice compartment to a goal compartment. If it entered an incorrect goal com-

FIGURE 2
RACCOON IN THE APPARATUS

partment, it usually jumped out at once and entered another—often the correct one. When the delayed training was introduced, it tore up the tape that had been put around the edges of the screen covering the lights in the adaptation compartment as well as that which had been used to cover up cracks in the floor. It habitually picked up lint from the floor, rolled it into a wad with its paw, and played with the wad.

Raccoon 2, who gave a good performance in the beginning of the experiment, stood motionless with its hair up when the delayed training was introduced. Then it slowly approached the goal box, placed one paw in it,

withdrew that, then placed the other paw in—repeating this several times before entering the goal box. Sometimes before it crept slowly to the goal box, it lay motionless on its stomach for awhile; however, the slightest noise on the part of the experimenter brought forth a response. When it was walking normally, it also picked up tiny pieces of lint and rolled them into wads.

Responses very different from those of the raccoons appeared in the cats, who, after they had entered the wrong compartment, often just sat and licked their fur. Sometimes they walked up to a goal compartment and sat in front of it until the time limit was up.

An analysis of errors made by the animals showed that in the beginning there was a tendency toward lack of position differentiation. Often after an animal had gone into a correct goal box, it would, on the next trial, enter again the goal box in which it had last been reinforced. This was particularly true of the cats, who also seemed to have difficulty with Compartments 1 and 3.

A wide range of individual differences among the animals exhibited itself in the solving of the discrimination problem, in the delayed test, and in the strength of motivation.

The results of this study imply that the animals have to adapt to the emotional aspects of delaying and that some trial and error learning is necessary before the delayed response becomes specific and accurate. Perhaps this emotional factor has to be controlled and dealt with before we can be sure that we are testing the limits of a particular species.

This investigation may be called preliminary to one that should be done using a much larger number of animals as well as additional species studied at comparable levels of maturation rather than necessarily at comparable age levels.

The concept of delayed conflict is an important one, and it is hoped that the technique employed in this experiment may suggest the use of a number of combinations of delayed conflicts involving extereoceptive motivations. Should these techniques be employed over long enough periods of time, they might furnish a different picture of the patterns of abnormal animal behavior from that posed by non-delayed conflict procedures utilizing hunger, electric shock, etc., as motivating forces.

E. Summary and Conclusions

Two raccoons and three cats were subjected to a modified version of the delayed reaction experiment. The motivation was light; the reward,

darkness in the goal box. The animals had to solve a discrimination problem involving differentiation between a rectangular door which had a triangle over it and two similar doors from which the triangles had been removed. If an animal entered the door with the triangle overhead, it was rewarded with darkness. It then had to undergo the delayed reaction test which involved the animal's looking at the triangle, then having the lights turned out and then, after the triangle had been removed, having the lights on again and retaining an impression of which door had previously had the triangle overhead. The influence of introducing the delay without removing the triangle was also studied and one of the animals subjected to a delayed conflict situation. Qualitative observations, too, were made on the animals.

The following conclusions are suggested from this study; such conclusions apply only to these particular animals and not to raccoons and cats in general, because of the smallness of size of the sample in this exploratory type of study:

1. The raccoons tended to select the correct goal box a greater proportion of time than did the cats. Statistical analysis found this to be significant at the .001 level.

2. A truncation analysis was made for the two raccoons for the entire series of 44 trials. Fisher's exact probabilities were computed under the hypothesis that the two raccoons were similar in their probability of selecting the goal box during the series of trials. The resultant probabilities indicate that there are less than four chances in 100,000 that the two raccoons have a similar likelihood of selecting the goal box correctly.

3. In all cases the error distributions for the two raccoons were similar. Further there did not seem to be any relationship between number of errors and length of trial period. This implied that the truncation time might not be as serious as it would appear on the surface.

4. The raccoons and cats were so different that no tentative decision could be made about length of time to enter the correct goal box. Further the truncation process makes some of the times meaningless.

5. Error rates per unit of time were studied for the two raccoons for all parts of the experiment. Raccoon 1 seemed to have a greater tendency to make errors, yet eventually found the correct goal box. Raccoon 2 was more sluggish and tended to commit fewer errors per minute, yet he needed to be pushed into the goal box more often.

6. Error rates versus trial time for the two raccoons were examined. The plots for the raccoons were extremely different, yet neither tended to indicate that error rates were related to time.

7. In the final delayed test for the raccoons, Raccoon 1 completed Trials 36 through 41 with no errors, seven of the 10 delayed tests being made under the time limit with 100 per cent accuracy. Raccoon 2 successfully completed Trials 37 through 41 consecutively and Trial 44, passing six out of the 10 delayed tests. The performance of both raccoons was statistically significant at the 1 per cent level.

8. Cat 3 showed patterns of pronounced muscular rigidity especially when it was subjected to a complex delayed conflict procedure. This rigidity completely disappeared when the animal was removed from the apparatus and placed in the living cage.

9. There were marked individual differences in the animals with regard to motivation, discrimination, ability to delay, and qualitative reactions to experimental procedures.

10. The introduction of the delayed training itself, without the removal of the triangle, seemed emotionally traumatic to the animals, suggesting that performance on the delayed test was partly influenced by the extent to which the subjects had become adapted to the shock of having established responses blocked.

References

1. Caldwell, W. E., & Boes, R. H. The application of light avoidance in a perceptual differentiation problem in the Pekin duck. *J. Genet. Psychol.*, 1956, **88**, 153-160.
2. Caldwell, W. E., & Mosman, K. F. The role of temperature change as reinforcement. *J. of Psychol.*, 1951, **32**, 231-239.
3. Caldwell, W. E., & Sandler, H. M. The role of gaseous formaldehyde as reinforcement in maze learning in albino mice. *J. of Psychol.*, 1952, **33**, 47-56.
4. Flynn, J. P., & Jerome, E. A. Learning in an automatic multiple-choice box with light as incentive. *J. Comp. & Physiol. Psychol.*, 1952, **45**, 336-340.

Department of Psychology
The George Washington University
Washington 6, D.C.

The Journal of Genetic Psychology, 1961, 98, 177-182.

STIMULUS DETERMINANTS OF AGGREGATIVE BEHAVIOR IN THE DOMESTIC CHICKEN*

Department of Psychology, University of Maine

ALAN BARON, GEORGE B. KISH, AND JOSEPH J. ANTONITIS[1]

A. INTRODUCTION

Research underway in our laboratory has indicated that domestic chickens communally reared in flocks or in pairs, will, in a standard test situation, approach and remain in close proximity with a stimulus animal. Such aggregative behavior was markedly evident when animals were observed at four and 10 weeks of age. In marked contrast, chickens who were isolated from social contact from the time of hatching did not show these tendencies at four weeks of age; however, extensive social experience introduced between the fourth and 10th week of life resulted in a significant change in their social reactivity. When observed at 10 weeks of age, they were indistinguishable from socially reared subjects. Several questions were raised by these findings. Of special interest was the identification of those elements of the total pattern of stimulation provided by the stimulus animal that are necessary for aggregative behavior.

Antonitis and Kish (1) investigated the reactivity of adult C57 Black mice to one another and found that more time was spent in the presence of an inactive stimulus animal than an active one. This finding was attributed to the consistent reinforcement received by the infant animal while in the presence of the relatively inactive mother; both before and after weaning, associations with active mice typically involve a pattern of non-reinforcing or even negatively reinforcing consequences. One would not, however, expect similar findings in a parallel investigation of the chicken, a non-mammalian form. Young chickens need not come into contact with less active adult animals in order to satisfy their primary drives and are, in fact, commonly raised for commercial purposes in same-age flocks from the time of hatching. Since the early social contacts of the chicken are ordinarily with other active young animals, active and mobile social stimuli should come

* Received in the Editorial Office on June 17, 1959.
1 This research was supported, in part, by a grant from the Wilson Coe Research Fund. We also wish to express our appreciation to Professors J. R. Smyth and J. E. Berry of the College of Agriculture, University of Maine, for their generous technical assistance.

to serve as highly effective secondary reinforcers because of their regular association with the acts of eating and drinking at the common food and water troughs. To test this hypothesis, in the present study 10-week-old domestic chickens with extensive social experience were observed, first, in their reactivity to another active stimulus animal and then, under one of three further conditions: (*a*) with an inanimate stimulus animal, (*b*) with a mirror image of themselves, and (*c*) with a life-size photograph of a chicken.

B. Subjects

Twenty-four White Rock chickens 10 weeks old served as subjects. Eggs were incubated by the Poultry Department of the University of Maine and brought to the laboratory shortly after hatching. Although the subjects differed with respect to their rearing during the first five weeks of life (i.e., some had been raised in social isolation), all were identically raised in communal living cages between the fifth and 10th week. As reported below, observations conducted when the animals were 10 weeks old provided no basis for assuming the presence of any differences between subjects as a function of their handling prior to the fourth week of life.

C. Apparatus

The apparatus was similar, in principle, to one developed by Antonitis and Kish (1) and was designed to measure the reaction of a subject animal to a stimulus object in terms of the amount of time spent by the former in close proximity to the latter. Essentially, it consisted of a rectangular subject compartment, 13 inches wide, 40 inches long, and 10 inches high, at both ends of which were located two display compartments, 13 inches wide, 8 inches long, and 9 inches high. The partition between the test area and the display compartments was made of ½ inch wire mesh so that the interior of the display compartment was clearly visible from the test area. All other vertical walls as seen from the inside were of unpainted wood. The floor of the subject compartment was constructed of wire mesh and divided into three equal sections. The third of the floor located nearest each of the display compartments was a pivoted platform which when depressed ¼ inch by the weight of the subject operated a leaf actuator microswitch. The floor of the apparatus was so constructed that all three segments were visually identical. The test apparatus was covered by a hardware cloth lid; the interiors of the subject and display compartments were illuminated by the overhead room lights. Two identical test apparatuses as described above were located

in the experimental room. All control and recording equipment were in an adjoining room.

D. Procedure

1. *Social Pretest*

Stimulus animals drawn from the laboratory colony and the same age as the subjects were put in one of the display compartments in each of the respective apparatuses. The display compartments employed were alternated from subject to subject. The subjects were then placed in the test area and permitted unrestricted activity for a two-hour period. The time spent on the platform nearest the stimulus animal was determined from self-starting electric clocks read at 15-minute intervals. Subjects were 10 weeks old at the time of this test.

2. *Stimulus Test*

Of a total of 29 animals observed under the previous conditions, 24 who had spent at least half of the total time on the stimulus platform were selected for further study. Subjects were divided into three equivalent groups, each subject having a matched partner in each of the other two groups. For the *Mirror Group,* a mirror 12 inches wide and 7 inches high was placed vertically in the forward part of the display compartment so that the subject's image was reflected and visible within the test area of the apparatus. In the *Photograph Group,* a life-size photograph of one of the stimulus animals in the usual sitting position assumed in the display compartment, was cut in outline and placed upright on a small stand within the display compartment. Finally, in the case of the *Inanimate Chicken Group,* a freshly sacrificed stimulus animal was placed in the display compartment and arranged insofar as was possible in a sitting position. Stimulus position was alternated between the two display compartments. Observations for these three groups were conducted for a one-hour period with clock readings taken at 15-minute intervals. This stimulus test and social pretest were separated by an average interval of about two days.

E. Results

Table 1 shows the percentage of the total test period spent by each of the subjects on the stimulus platform during the social pretest and the stimulus test. The data for the *Mirror Group* show clearly that the subject's image of himself was as potent a stimulus for aggregative behavior as the stimulation provided by a live chicken. In both the social pretest and mirror test periods the subjects spent an average of 78 per cent of total test

time in the vicinity of the stimulus display compartment. In contrast, the data for the other two groups show that the inanimate animal and the photograph were markedly inferior to a live stimulus animal in evoking aggregative behavior. For the *Inanimate Chicken Group,* the mean percentage of total test time decreased from 78 in the presence of a live stimulus during the social pretest to 47 in the inanimate stimulus test period. For the *Photograph Group,* the mean percentage of total test time fell very

TABLE 1

PERCENTAGE TIME SPENT ON THE STIMULUS PLATFORM BY THE INDIVIDUAL MEMBERS OF EACH OF THE THREE EXPERIMENTAL GROUPS DURING SOCIAL PRETEST AND STIMULUS TEST PERIODS

Mirror group			Photograph group			Inanimate chicken group		
Subject No.	Social pretest	Mirror test	Subject No.	Social pretest	Photo-graph test	Subject No.	Social pretest	Inani-mate chicken test
1M	94	91	1P	93	0	1I	100	18
2M	87	64	2P	91	0	2I	89	57
3M	85	100	3P	83	2	3I	85	0
4M	82	76	4P	82	0	4I	81	43
5M	79	82	5P	81	0	5I	79	58
6M	73	35	6P	74	36	6I	75	84
7M	73	72	7P	72	1	7I	60	80
8M	53	99	8P	54	75	8I	57	36
Mean	78.3	77.4		78.8	14.3		78.3	47.0

markedly from 78 in the presence of a live stimulus to 14 in the presence of the photograph. In both of these groups the decreases in percentage time are statistically significant ($P = .05$, $P = .02$, respectively).[2] These differences were confirmed through an analysis of variance of the three groups during the stimulus test which revealed intergroup variability of acceptable significance ($P = .05$).[3]

F. DISCUSSION

That flock-reared chickens will aggregate closely with one another is not an uncommon naturalistic observation. We have found that when an individual is isolated from the flock and observed in our standard test situation with another chicken, it can be expected to spend somewhere between 60 per cent and 80 per cent of the test period in proximity with the stimulus animal. The present investigation has revealed that such aggregative

[2] Wilcoxon's nonparametric test for paired replicates (3).
[3] Friedman's nonparametric analysis of matched replicates (3).

behavior can be induced by stimuli other than those provided by the actual presence of a live member of the same species.

The striking finding that a mirror image elicits the same degree of aggregative behavior as does an actually present stimulus animal is understandable when the perceptual capacities of the chicken are considered. The chicken is predominantly a visual animal (4). Although a limited degree of stereoscopic vision is possible, variations in size, differences in brightness, and particularly shadow effects seem to be the most important cues of depth (Benner, as cited in Wood-Gush, 4). Under the conditions of our experiment it seems hardly likely that the subject animals were capable of differentiating between an actually present stimulus animal and their own actively moving mirror image; certainly our results do not reveal any differences in this respect.

In view of our initial prediction that active social stimuli are the prepotent cues for aggregative behavior in the chicken, the relative inferiority of an inanimate chicken to a mobile chicken or to the mirror image of the subject is not too surprising. It is worth noting, however, that the inanimate social stimulus did evoke some degree of approach behavior in the majority of our subjects. In comparison, the photograph of the chicken was much less effective possibly because of its paucity of visual shadow cues in addition to its two-dimensional character.

In comparing the results of the present study with a study of aggregative behavior in DeKay snakes by Noble and Clausen (2), the similarity in the behavior of these two oviparous forms is striking. In both domestic chickens and in DeKay snakes, aggregative behavior is aroused to a higher degree by a mirror image of the subject than by an inanimate social stimulus. It appears, too, that in both these species the movement of another member of the same species is an important factor in evoking the aggregative response. But, as has been noted, aggregative behavior in C57 Black mice is evoked to a higher degree by inactive rather than active social stimuli. We propose that in the instance of rodents, the nursing of young by immobile mothers endows immobile social stimuli with secondary reinforcing potential. Conversely, among domestic chickens and snakes, from the time of hatching, the young typically fend for themselves in procuring nutrition and hence movements of other young animals are associated with primary drive reduction. The hypothesis initially suggested to the effect that reactivity to active and inactive social stimuli is a function of the conditions under which nutrition and other forms of reinforcement are obtained during the early weeks of life appears to have some validity.

G. Summary

Twenty-four 10-week-old White Rock domestic chickens were observed in a standard test situation, first with respect to their aggregative reaction to another chicken and then in their reaction to either an inanimate chicken, a photograph of a chicken, or to their own mirror image. It was found that a mirror image is as effective as the actual presence of a live stimulus animal. The inanimate chicken elicited a reduced degree of aggregative behavior; the photograph virtually none at all. The results were accounted for in terms of the importance of motility of social stimuli as cues that are regularly associated with primary drive reduction in the reinforcement history of chickens.

References

1. Antonitis, J. J., & Kish, G. B. Reactions of C57 Black male mice to active and inactive social stimuli. *J. Genet. Psychol.*, 1955, **86**, 115-130.
2. Noble, G. K., & Clausen, H. J. The aggregative behavior of *Storeria dekayi* and other snakes with especial reference to the sense organs involved. *Ecol. Monog.*, 1936, **6**, 269-316.
3. Wilcoxon, F. Some Rapid Approximate Statistical Procedures. New York: American Cyanamid Company, 1949.
4. Wood-Gush, D. G. M. The behavior of the domestic chicken: A review of the literature. *Brit. J. Anim. Behav.*, 1955, **3**, 81-110.

Department of Psychology
University of Maine
Orono, Maine

The Journal of Genetic Psychology, 1961, 98, 183-186.

STIMULUS AND REWARD DISPLAYS IN DISCRIMINATION LEARNING*

Departments of Psychology, Emory University and University of Wisconsin

A. J. Riopelle and Harry F. Harlow[1]

A. Problem

A number of investigators have compared the efficacy of differing modes of stimulus display on discrimination learning. Two of the most important conclusions drawn from such studies are (*a*) the relative ease with which "objects" are discriminated in comparison with patterns and (*b*) the importance of the spatial contiguity of stimulus and response (1, 5, 6, 7). Contiguity of stimulus and reward is important also according to Jarvik (3). He showed that naive chimpanzees and monkeys learned to discriminate between differentially colored cubes of bread virtually without error (3). He reported also that discrimination learning was faster when food was *within* a stimulus object than when food was *under* it (4). The rationale for the results was that the technique in which food was located within the plaque emphasized contiguity of stimulus and reward whereas the other technique did not, since the chimpanzee separated the two when he displaced the plaque from the foodwell.

Because no direct comparison has been made between the importance of the contiguity of stimulus and reward and the importance of display conditions for discrimination learning the following experiment was designed.

B. Method

1. *Subjects*

Sixteen young *Macacus cynomolgus* (=*M. irus*) monkeys from the Emory University primate behavior laboratory participated in the experiment. Prior to this investigation they were tamed and were trained to displace a single object from a foodwell or spin it around to get food reward.

2. *Apparatus*

All animals were trained in the Emory version (8) of the Wisconsin General Test Apparatus (2). This apparatus displays pairs of stimulus-objects to a caged monkey in order for him to exhibit a preference.

* Received in the Editorial Office on June 22, 1959.
1 This work was performed under Contract No. AT-(40-1)-1441 with the Atomic Energy Commission.

Stimuli consisted of cubes of wood, two inches on a side. On one face of the cube was a circular indentation 0.5 inches deep and 0.75 inches in diameter. In the center of this depression was a short, pointed nail on which a raisin could be impaled. Pairs of stimuli defined problems of two types: Stimuli in the 100 per cent problems were uniformly colored on all surfaces. Thus, discrimination was between, for example, a red cube and a brown cube. Stimuli in 25 per cent problems were of the same general construction except that only the central 25 per cent (1.0 inch square) was colored; the remaining portion of all six surfaces was white. Critical discriminations involved pairs of the following eight colors: red, green, black, brown, orange, blue, beige, pink.

3. *Procedure*

Standard test-trial procedures (8) were used to permit simultaneous discrimination with the noncorrection method. All animals tapped the cube of choice a glancing blow with their hands so as to spin it (exposing the food nail) and displace it from the foodwell. The orientation of the test stimuli was such that the monkey could not see the food until the block was rotated or displaced from the foodwell.

Twenty-five trials were allowed on each problem, two of which were presented each day. One of the problems was of the 25 per cent type and the other was of the 100 per cent type.

The experiment was conducted in two phases. Animals 100, 101, 102, 104, 106, 108, 110, and 124 comprised Group *A* and were tested first on the displacement procedure in which they displaced the test object from a foodwell for food reward. Animals 112, 114, 116, 118, 120, 122, 126, and 128 comprised Group *B* and were tested first on the rotation procedure in which they rotated the stimulus-object in order to remove the food impaled on the nail. During the second phase of the experiment the procedures were reversed for the two groups. Four problems of the 25 per cent type and four of the 100 per cent type were presented to each animal in both phases. Every attempt was made to maximize the number of color combinations involved in the problems to reduce interproblem transfer.

C. Results

The over-all level of proficiency of these animals on each problem was 61 per cent correct responses. Comparisons among the principal variables are shown in Table 1. Each line of the table shows a comparison between two values of the variables of primary interest. Values significantly higher than their counterparts are denoted by asterisks. Differences among conditions

were tested against the pooled interaction of animals within groups by conditions. The one exception was a comparison between groups (equivalent to comparing the two sequences of testing) which was tested against animals within groups.

TABLE 1

COMPARISON

Phase I (54%)	vs	Phase II (68%)***	
Displacement Procedure (62%)	vs	Rotation Procedure (60%)	
25% Problems (56%)	vs	100% Problems (65%)***	
Group D-R (58%)	vs	Group R-D (64%)*	

* Denotes significance at 0.05 level.
*** Denotes significance at 0.001 level.

In addition to a significant improvement in performance between phases that was found, a significant difference in favor of the 100 per cent discrimination as opposed to the 25 per cent discrimination was also found. Finally, animals which were tested first on the experimental procedure and then on the control procedure were on the average slightly superior to those trained in the opposite sequence. Neither the interactions nor individual differences were significant sources of variation.

D. Discussion

The improvement in performance between Phase I and Phase II confirms data expected on the basis of learning-set theory (2). The difference in difficulty existing between the 25 per cent problem and the 100 per cent problem is of special interest not only because it confirms earlier data obtained by the displacement procedure (9), but also because the factor is of equal importance in the rotation procedure. The absence of a significant interaction between procedures and problem types is evidence for this interpretation. If sheer contiguity of food and critical color were the primary determinant of performance, the 25 per cent problems would be solved about as readily as the 100 per cent problems under the experimental procedure, for in both situations the food is fixed to a differentiating aspect of the object. Whatever benefit might have been gained from the contiguity of food and color did not carry through to the time of stimulus selection. Yet it is the perceptual process at this moment which must be made more efficient in order to yield an improvement in performance. For this reason, efficient display relations will have generally beneficial effects whereas stimulus-reward relationships are more restricted in their effects.

E. Summary

Sixteen cynomolgus monkeys were trained to discriminate between differently colored cubes of wood under an experimental condition in which a raisin was impaled on a small nail on the reverse side of the block and under a standard condition in which the food lay in a foodwell beneath the test objects. Eight of these problems differed completely and the remaining eight differed in 25 per cent of the surfaces.

Performance on the 100 per cent problems was superior to that on the 25 per cent problems. Location of reward, on the other hand, was unimportant.

References

1. Harlow, H. F. Studies in discrimination learning by monkeys: V. Initial performance by experimentally naive monkeys on stimulus objects and pattern discriminations. *J. Gen. Psychol.*, 1945, **33**, 3-10.
2. ———. The formation of learning sets. *Psychol. Rev.*, 1949, **56**, 51-65.
3. Jarvik, M. E. Discrimination of colored food and food signs by primates. *J Comp. & Physiol. Psychol.*, 1953, **46**, 390-392.
4. ———. Simple color discrimination in chimpanzees: Effect of varying contiguity between cue and incentive. *J. Comp. & Physiol. Psychol.*, 1956, **49**, 492-495.
5. Jenkins, W. D. A spatial factor in chimpanzee learning. *J. Comp. Psychol.*, 1943, **35**, 81-84.
6. McClearn, G. E., & Harlow, H. F. The effect of spatial contiguity on discrimination learning by rhesus monkeys. *J. Comp. & Physiol. Psychol.*, 1954, **47**, 391-394.
7. Murphy, J. V., & Miller, R. E. The effect of spatial contiguity of cue and reward in the object-quality learning of rhesus monkeys. *J. Comp. & Physiol. Psychol.*, 1955, **48**, 221-224.
8. Riopelle, A. J. The facilities of the Emory University primate behavior laboratory. *J. of Psychol.*, 1954, **38**, 331-338.
9. Warren, J. M. The influence of area and arrangement on visual pattern discrimination learning by monkey. *J. Comp. & Physiol. Psychol.*, 1953, **46**, 231-236.

Yerkes Laboratories of Primate Biology
Orange Park, Florida

Department of Psychology
University of Wisconsin
Madison 6, Wisconsin

The Journal of Genetic Psychology, 1961, 98, 187-192.

IMPULSIVITY AND SEX PREFERENCE*

Department of Psychology, Bowling Green State University

B. Sutton-Smith and B. G. Rosenberg[1]

A. Introduction

There is an increasing agreement that impulsivity is an important temperamental dimension (Murray, 1938; Sanford, 1943; Guilford, 1959; Twain, 1957). For some time there has been consensus among group workers that it is behavior of practical significance (Polansky, 1950; Redl & Wineman, 1951). Because persons who act on the spur of the moment without thinking (Guilford, 1959) and display an inability to inhibit an impulse (Goldman-Eisler, 1951) are often the initiators of disruptive behavior in situations of stress and ambiguity (Polansky, 1950), it is important to be able to identify them and to know the conditions which are most propitious for their self-control. The identification of impulsive children has been approached with the development of a 19-item questionnaire scale (Sutton-Smith & Rosenberg, 1959).

Redl and Wineman (1951) observed that a group of highly disturbed boys whose behavior was frequently impulsive and disruptive were able to play together successfully at quiet and orderly games (e.g., cards), though they seldom played together successfully for long at more open ended aggressive games (e.g., Tarzan) or even at unstructured activities (e.g., arts and crafts). An examination of the games of 8- to 12-year-old children, however, reveals that quiet, orderly, and highly-structured games are more often the games of girls than they are the games of boys [(e.g., London Bridge, dominoes); Rosenberg & Sutton-Smith, 1959)].

This paper investigates the possibility present in Redl's observation that there may be some essential connection between impulsivity in boys and a preference for feminine activities. Specifically it examines the hypothesis that boys high on impulsivity will show greater preference for girls' games than will boys low on impulsivity.

The gaming preference of highly impulsive girls is a related question. A recent study by Sanford, Webster, and Freedman (1957) describes the

* Received in the Editorial Office on June 25, 1959.
1 The present study was aided by a grant from the Scholarly Advancement Committee, Bowling Green State University.

derivation of a scale of impulse-expression with college females. In discussing the relationships found with the J-scale, the authors note the high negative relationship obtaining between an Mf measure of passivity and the impulse-expression measure in females. They further note the positive correlation between impulse-expression and an independent measure of dominance in women. These findings have suggested to the authors the hypothesis that highly impulsive girls will gratify their dominance needs through gaming activities characteristically preferred by the average boy.

B. Procedure

An Impulsivity Scale (Sutton-Smith & Rosenberg, 1959) was administered to a sample of 351 children in the fourth, fifth, and sixth grades in two elementary schools.[2] The same children checked their game preferences on a 181 item revised form of the Terman Play Inventory (Terman, 1926). Previous analysis of this list had demonstrated that 18 items were chosen more often by boys than girls ($P = .05$), and 40 items were chosen more often by girls than boys ($P = .05$) (Rosenberg & Sutton-Smith, 1960). These basic 58 items were used in judging the masculinity or femininity of boys and girls scoring high or low on the Impulsivity Scale.

The data were analyzed by two procedures. First, two scales, one for masculinity and one for femininity, were constructed composed of game items differentiating between boys and girls. Those items of greatest statistical significance in differentiating the sexes were most heavily weighted. The construction and discriminating power of these scales is described elsewhere (Rosenberg & Sutton-Smith, 1959). The upper and lower quartiles of boys and of girls on impulsivity were compared in terms of their scores on the masculinity and femininity scales. Second, the upper and lower quartiles of boys and girls were then compared in terms of the *types* of items which differentiated significantly between them. These items were examined to determine whether they were masculine, feminine, or neutral (i.e., failed to discriminate between the sexes on the original criterion list).

C. Results

The results of the comparison between boys high and low on impulsivity show that while there is no significant difference between these boys on the masculinity scales, there is a significant difference between them on the fem-

[2] The authors wish to thank Mr. H. Lehtomaa, Mr. R. Knestrict, and Mr. N. Jacobs and their staffs for making the present sample available.

ininity scale with the highly impulsive boys achieving the higher mean score on femininity (P=.05). That is, although the high and low boys check masculine items with more or less the same frequency (see Table 1), the highly impulsive boys check significantly more feminine items.

TABLE 1
MEANS AND STANDARD DEVIATIONS ON THE MASCULINITY AND FEMININITY SCALES OF BOYS AND GIRLS SCORING IN THE UPPER AND LOWER QUARTILES OF THE IMPULSIVITY TEST

		Boys		Girls	
		Masculinity	Femininity	Masculinity	Femininity
Upper quartile in impulsivity scale	M =	43.54	47.67**	23.31*	79.85
	SD =	11.12	15.29	9.30	26.31
	N =	24	24	26	26
Lower quartile in impulsivity scale	M =	40.43	35.56	15.26	74.27
	SD =	9.91	21.95	10.99	22.10
	N =	23	25	35	33

* Significant at the .01 level of confidence.
** Significant at the .05 level of confidence.

The results of Table 1 also suggest similar behavior on the part of girls high and low on impulsivity, but in the opposite direction. The two groups of girls are not differentiated on the femininity scale, but the highly impulsive girls check significantly more masculine items than do the girls low on impulsivity (P=.01).

Table 2 presents the game items which differentiated between boys in the

TABLE 2
GAME PREFERENCES DIFFERENTIATING BOYS IN THE UPPER AND LOWER QUARTILES ON IMPULSIVITY

	.05	.05 .10	.10 .20
High	School (F)*	Dressing up (F) London Bridges (F) Red rover (F) Store (F)	Black magic (N) Build snowmen (F) Crack the whip (F) Doctors (F) Dominoes (N) Drop the handkerchief (F) Farmer in the dell (F) Horses (N) Houses (F) Musical chairs (F)
Low	Dance (F)		Cooking (F) Make collections (N) Tag (N)

* *F* indicates an item preferred more by girls than boys on the original criterion list (P = .05). *M* indicates an item preferred more by boys than girls on the original criterion list (P = .05). *N* designates an item which failed to discriminate between the sexes on the original criterion list (Rosenberg & Sutton-Smith, 1959).

upper and lower quartiles of the Impulsivity Scale. It is clear that the former show a marked preference for games typically chosen by girls. Twelve of their 15 items are feminine and three are neutral. The boys low on impulsivity choose four items which differentiate them from the highly impulsive boys. Three of these are feminine and one is neutral. In the latter case, two of the three feminine items are of a more mature developmental level than the feminine items discriminating in favor of the highly impulsive boys (Lehman & Witty, 1927).

The items which differentiate the highly impulsive girls from girls of low impulsivity are presented in Table 3. The highly impulsive girls choose the only masculine item. The girls low on impulsivity choose more feminine items (ratio of 4:1).

TABLE 3
GAME PREFERENCES DIFFERENTIATING GIRLS IN THE UPPER AND LOWER QUARTILES ON IMPULSIVITY

	.05	.05 .10	.10 .20
High	Wrestling (M)	Leapfrog (F)	Tiddlywinks (N) Shuffleboard (N) Racing (N)
Low	Huckle buckle beanstalk (F) Sewing (F) Simon says (F) Wall dodge ball (N)	Fly kites (N) Walk on stilts (N)	Checkers (N) Hopscotch (F) Skating (N) What time is it (N)

D. DISCUSSION

The results are in the direction hypothesized. Redl's observation that quiet, structured games allow highly disturbed and impulsive children to be most self-controlled is supported by these game preferences of boys whose impulsivity is within the normal range. It should be noted that there was a significant mean difference in favor of the boys on the original impulsivity standardization group which implies that the Impulsivity Scale is also, in part, a measure of masculinity. Thus, it is all the more surprising that high scoring boys on this test should have highly feminine scores on the masculinity-femininity indices and prefer more feminine games.

At this point this inconsistency in the behavior of boys is not fully understood. It will be noted that the types of games chosen by highly impulsive boys are normally played by children younger than those used as subjects in this study. This suggests that these play preferences may represent an actual immaturity in the behavior patterns of the impulsive boys. The boys may prefer feminine games because they are associated in some way with

the gratifications of an earlier chronological age period. Tentatively, the authors advance the hypothesis that the impulsive boy is behaving regressively. The impulsive, code-breaking interruptive type of behavior which he responds to on the Impulsivity Scale, though possessing a pseudo-masculine quality, is closer in nature and effect to the behavior typical of a preschool child. An inability to inhibit impulses is a characteristic of younger children, and has the effect of bringing those children into closer relationship with the adults who must contend with them. Similar impulsivity in older children appears to be an attempt to manage anxiety through acting-out behavior (Fenichel, 1945, p. 166), and also has the general effect of forcing the adults in control to relate more closely to them by structuring the environment for them. In defense of themselves and other children, the adults in charge are compelled to clarify and insist upon the codes and rules implicit in all behavior settings (Gump and Sutton-Smith, 1955). Thus, the impulsive boys' behavior leads to the type of imposed ego controls from without that adults regularly supply for very young children. The game preferences of these boys seem to give support to this line of reasoning. As Redl and Wineman have said, the quiet and orderly nature of these games is also a means of providing ego controls from without.

In summary, the Impulsivity Scale apparently registers the boy's awareness that he is "at the mercy of his immediate instinctual urges" (Polansky, 1950), and the play preference records his need to counter-act these impulses with controls from without.

The responses of girls appear to have a different connotation. Their high scores on the Impulsivity Scale are an indication of high preference for masculine activities and are consistent with the girls' high scores on the masculinity scale. Not only are the girls' choice patterns consistent, they are also much more culturally acceptable than the inconsistent choice patterns of the highly impulsive boys. It is not unusual for girls to choose masculine-type activities in Western Culture, but it is much less acceptable for boys to exhibit feminine preferences (Brown, 1958; Rosenberg & Sutton-Smith, 1960).

In the light of these and other findings (Terman & Miles, 1936), the authors would like to draw incidental attention to the fact that a simple play check list may be a subtle indicator of maturity and sex role identification in children.

E. Summary

The present study sought to test the hypothesis that children scoring high on impulsivity would manifest preferences in gaming activities more

characteristic of the opposite sex. The results tend to confirm the hypothesis. An explanation for this preference was given, emphasizing the regressive, immature nature of the highly impulsive boys' choices and the way in which they elicit controls from adults in the environment.

References

1. Brown, D. G. Sex role development in a changing culture. *Psychol. Bull.*, 1958, **55**, 232-242.
2. Fenichel, O. The Psychoanalytic Theory of Neurosis. New York: Norton, 1945.
3. Goldman-Eisler, F. The problem of "orality" and its origin in early childhood. *J. Ment. Sci.*, 1951, **97**, 765-782.
4. Guilford, J. P. Personality. New York: McGraw-Hill, 1959.
5. Gump, P. V., & Sutton-Smith, B. Activity settings and social interaction. *J. Orthopsychiat.*, 1955, **25**, 755-760.
6. Lehman, H. C., & Witty, P. A. The Psychology of Play Activities. New York: Barnes, 1927.
7. Murray, H. A. Explorations in Personality. New York: Oxford Univ. Press, 1938.
8. Polansky, N., Lippitt, R., & Redl, F. An investigation of behavioral contagion in groups. *Hum. Relat.*, 1950, **3**, 319-348.
9. Redl, F., & Wineman, D. Children Who Hate. Glencoe, Ill.: Free Press, 1951.
10. Rosenberg, B. G., & Sutton-Smith, B. A revised conception of masculine-feminine differences in play activities. *J. Genet. Psychol.*, 1960, **96**, 165-170.
11. ———. The measurement of masculinity and femininity in children. *Child Devel.*, 1959, **30**, 373-380.
12. Sanford, R. N. Personality patterns in school children. *In* Barker, R. G., Kounin, J. S., & Wright, H. F. (*Eds.*), *Child Behavior and Development.* New York: McGraw-Hill, 1943.
13. Sanford, R. N., Webster, H., & Freedman, M. Impulse expression as a measure of personality. *Psychol. Monog.*, 1957, **71**, No. 11.
14. Sutton-Smith, B., & Rosenberg, B. G. A scale to identify impulsive behavior in children. *J. Genet. Psychol.*, 1959, **95**, 211-216.
15. Terman, L. F. Genetic Studies of Genius. Vol. 1, Palo Alto: Stanford Univ. Press, 1926.
16. Terman, L. F., Miles, C. C. Sex and Personality. New York: McGraw-Hill, 1936.
17. Thurstone, L. L. Thurstone Temperament Schedule. Chicago: Science Research Associates, 1950.
18. Twain, D. C. Factor analysis of a particular aspect of behavioral control: Impulsivity. *J. Clin. Psychol.*, 1957, **13**, 133-136.

Department of Psychology
Bowling Green State University
Bowling Green, Ohio

The Journal of Genetic Psychology, 1961, 98, 193-201.

AN ANALYSIS OF FACTORS RELATED TO EDUCATIONAL ACHIEVEMENT*

College of Education, University of Georgia

RACHEL S. SUTTON

Today's emphasis on achievement and excellence has aroused renewed interest in motives for learning and in the motivation of pupils. The motivation of individuals to excellence does not necessarily imply motivation of individuals to genuine social worth and intelligent group enterprise. Man's greatest developmental task is the achievement of world-wide cooperative living. Achievement should be viewed in terms of human endeavor that results in the greatest good for the largest number. Individual achievement is not viewed solely in terms of single attainments but also by a composite of attainments that others make in response to the individual as a stimulus. Individual achievement is measured by its stimulus value for group achievement. The dependence of self upon the perception of others is a primary clue to the social nature of man and to his incapacity for complete autonomy of perception or action.

The educational achievement of a child is a product of the maturational forces within him and of the experiences provided by the environment. Each child is expected to meet certain standards of excellence in areas of behavior deemed important by the society. Some children have high achievement motivation working very hard in many types of endeavor, and others have low, performing far below ability with no inclination to strive for excellence.

The questions with which this paper is concerned are: (*a*) Is a child's achievement related only to immediate conditions under which the child performs or to a synthesis of the child's individual school history? (*b*) What accounts for the uniqueness and continuity of a child's achievement? (*c*) Do the factors that account for uniqueness and continuity of achievement in the personality of one individual account for them in the personality of others? (*d*) Is there sufficient similarity among these factors for any generalizations concerning achievement to emerge?

Educators are inclined to expect a high degree of relationship between capacity and achievement. Research has shown that in the realm of intellectual achievement factors other than sheer capacity play important roles.

* Received in the Editorial Office on June 26, 1959.

Jersild (8) reported that an evaluation achievement on intellectual grounds has limited value, even within its own sphere, unless some attention is paid to non-intellectual factors. The social qualities that enable a person to get along well with others should not be ignored. High intelligence and intellectual attainment greatly prized in most schools does not guarantee a higher quality of personal adjustment nor a superior relationship with others. Holt (7) found that individuals lacking in ability to make friends or to adapt themselves to the requirements of social living tend to exhibit the most extreme levels of aspiration in a compensatory attempt to bolster self-esteem. Interest, zeal, and practice are accountable for differences in achievement. Emphasis placed on the segments of intellectual achievements measured by standard intelligence and achievement tests is excessive.

Allport (2) developed the concept that characteristics of achievement are unique for each person. The life style of an individual begins to take shape as the person endeavors to establish a firm sense of security, a life space in which he is free to grow. Life space includes the physical dimensions of daily living, constellation of forces significant in life, and the feelings the individual has about himself and those whom he includes in his life space.

In longitudinal studies of many cases Olson (11) observed that measures of school achievement tend to mesh with the matrix of total growth patterns. Whaley (16) also made case studies of elementary school children and decided that some plan for an over-all description of a child gave promise for a better understanding of the intricate relationships between growth patterns and achievement at the elementary and high school levels.

Sears (13) reported research to obtain a more precise denomination of classroom and teaching conditions that serve to modify certain salient qualities of a child's behavior, especially those that are important for the maximizing of his talents and potentialities. Eight children from a sixth grade class of 26 were observed with considerable care. Emphasis was placed on natural behavior in a natural setting. Natural was defined to mean a situation where events occurred normally whether research was being conducted or not. For each child an extensive clinical evaluation was made and a number of behavioral goals were established. There were ample data to make a judgment on the strength of a broadly conceived motivation to achieve.

Fennema (6) reported that among a group of third grade children some did well on intelligence and reading tests and others did well on a test of mental imagery. Among the 39 children tested there were negative correlations of .40 to .50 between intelligence and imagery scores. Children who

formed the fewest mental images were often the fastest readers. Some fast readers understood and remembered less of what they read than the slower readers did. Some children who formed few mental images were poorly adjusted socially and personally. Inferences were made that mental images are a measure of the sense of freedom a child brings to his explanations of his world and his dealings with people; in reading for pleasure or for creative purposes it may be essential to form mental images; teaching techniques could be extended to enrich comprehension through mental imagery.

In a study to determine personality differences in children related to strict or permissive parental discipline Watson (15) found no clear personality advantage associated with strict discipline in a good home. Where differences emerged they were consistently to the credit of the more permissive upbringing. The study failed to distinguish the extent to which the advantages associated with permissiveness were due to the procedure alone or to which more permissive parents may convey hereditary or cultural assets related to permissive attitudes.

McClelland, Atkinson, Clark, and Lowell (9) suggested that in order to develop an achievement approach motive parents or circumstances must contrive to provide opportunities for mastery which, because they are just beyond the child's present knowledge will provide continuing pleasure. If the opportunities are too limited, boredom should result and the child should develop no interest in achievement and have a low achievement score when he grows up. If the opportunities are well beyond his capacities, negative affect should result, and he may develop an avoidance motive as far as achievement is concerned. The child must begin to perceive performance in terms of standards of excellence. Whether the performance be grooming, playing football, or landing a summer job it can give evidence of an achievement motive if there is affect or involvement connected with an evaluation of it.

Winterbottom (17) obtained data on the effect of the achievement motive on a person's conception of his relation to the world. The achievement motive does not develop and function in a vacuum. It is one aspect of a complex personality structure and only case studies of individuals can begin to give the total picture. Maturity as measured in these ways represents the willingness of a person to accept responsibility and act independently like an older person, a characteristic which should by definition be related to high achievement motivation. Churchman (3) designated a measure of intellectual maturity as the capacity to feel less and less satisfied with

answers to better and better problems. Maslow (10) believed that the foundations of character were established only in the sense that the child was free to become and was well launched on a course of continuous and unimpeded growth. Coan and Cattell (4) studied the responses of 198 first and second grade children in Decatur, Illinois, to a 200-item questionnaire and indicated the reproducible personality factors that emerged from a comparison with the results of an earlier study.

Shirley (14) found that a child's level of adjustment depends little upon the extrensic features of the day, and even little upon his health. It depends much more upon the wholesomeness of his upbringing, and the security, confidence, and affection given him by his parents. A secure and wholesomely loved child goes forth to meet new experiences in a spirit of adventure and comes out triumphant in his encounters with new places, new materials, and new friends, young and old. A child that is over-sheltered and under-loved goes forth from home with misgivings and doubts and gives an impression of inadequacy and immaturity in his encounter with new experiences that makes him unwelcome either in the society of adults or children.)

The subjects for this investigation were 85 children currently enrolled in three fifth grades at one of the public schools cooperating with the University of Georgia in its program for the education of teachers. Cumulative records have been kept on these children since they entered kindergarten in 1953. The records included a complete health history, scores made on intelligence and achievement tests given on several occasions, scores made on particular reading tests, reports from the Psychology Clinic and the Speech Clinic at the University of Georgia for certain individuals, copies of the reports sent quarterly to parents, and the annual achievement summary made by each teacher.

The school is located in one of the oldest sections of Athens. The area it serves is one of beautiful old homes, new subdivisions, and low income housing units. The children come from predominately middle class families, upper and lower, with a small number from lower upper class and an equally small number from the upper lower class.

There is a tradition of community interest in the school which is described in a bulletin of the Cooperative Program in Elementary Education (5). Meetings planned for parents and families are well attended. Parent enthusiasm for improving the school has existed over a long period of time. This is reflected in the live, active Parent-Teacher organization, in the spacious, appropriately landscaped grounds, in the attractive, colorful, and

well equipped classrooms, cafetorium, and halls. It is also reflected in the interest and support given the school band, choirs, patrols, festivals, and exhibits. There is little turnover and transfer in faculty and students.

Although formal reports are sent to parents quarterly numerous conferences are arranged between parents and teachers. Special meetings are planned during the year for the purpose of explaining the school's program to parents. The clinics at the University of Georgia are open to children with special problems in skill and personality development.

In the analysis of factors related to educational achievement an examination was made of each child's cumulative folder. Other attempts to study the individual were made which included self-reports, descriptive ratings by peers and teachers, observations by assistants, and inventories designed to indicate pupil status in several aspects of personality. As a means of determining the pupil's level of satisfaction with his current educational achievement he was asked to rate his performance on a four-point scale in such areas as general behavior, science, mathematics, social studies, and English. Each response was weighted and a total level-of-satisfaction score was computed. The four points were: satisfied, fairly well satisfied, rarely ever satisfied, and never satisfied. In addition each pupil wrote a brief statement about his plan for the future.

Each child was asked to choose a boy and girl: (*a*) to assist him with homework, (*b*) to serve on a committee with him, (*c*) to perform a difficult task, (*d*) who usually maintained high quality performance. Children received from 0 to 39 choices with a midpoint of 4. In each of the three classrooms several children received far more choices than the majority.

Teachers of the three groups were asked to rate each child on a four-point scale in terms of: how well the pupil stands up under criticism, how much confidence the pupil shows in his ideas, how secure the pupil is in his social behavior, and how successful the pupil is in his relationships with his classmates. The ratings were expressed as: exceedingly, very, fairly, and not very well.

The 85 children were given a personality inventory (12) in April, 1959, and again six weeks later for retest reliability. The inventory provided a measure of ascendancy-submission, introversion-extroversion, and emotional stability. The investigator found slightly higher correlations between the first and second administration than those found by the authors on four administrations of the inventory.

The California Test of Mental Maturity was administered twice. Intelligence quotients of the subjects ranged from 54 to 149 on the first test given

in January, 1957. The median score was 111. Intelligence quotients ranged from 67 to 159 on the second test given in November, 1958, with the median score at 125. Scores on the California Achievement Test given in January, 1957, ranged from 2.4 to 5.5 with a median score of 4.3. Sixty-two children of the 85 then enrolled in the third grade scored above the standard norm of 3.5. The California Reading Test was given in November, 1957, and again in May, 1958. Scores on the November test ranged from 2.5 to 6.7 with the median at 4.2. Scores on the May test ranged from 2.6 to 8.0 with the median at 5.3. During the six months period an experiment in teaching reading to small groups of children arranged according to ability was conducted and reported by Aaron, Goodwin, and Kent (1). Gains over the period ranged from 0.1 to 2.7 with the median score at 1.1.

From composite ratings on the several measures used four categories of achievers were formed: (*a*) Children who consistently showed substantial educational achievement. (*b*) Children who showed high, sporadic educational achievement. (*c*) Children who appeared to reach or exceed expectancy. (*d*) Children who achieved below expectancy.

Characteristics of the children who consistently showed substantial educational achievement were: (*a*) Their intelligence quotients were over 125. (*b*) They were dissatisfied with their present achievement. (*c*) They had well formulated plans for the future. (*d*) They received from 21 to 37 choices by their peers as achievers. (*e*) They made high scores on emotional stability in the personality inventory. (*f*) They were rated as excellent and superior by their teachers.

Children who showed high, sporadic educational achievement had the following traits in common: (*a*) Their intelligence quotients were over 140. (*b*) They were dissatisfied with present achievement. (*c*) They were highly imaginative about the future. (*d*) They received from 0 to 4 choices by their peers as achievers. (*e*) They made high scores on the ascendance-submission section of the inventory. (*f*) They were rated as fair and good by their teachers.

Children who appeared to reach or to exceed expected educational achievement had the following characteristics: (*a*) Their intelligence quotients were average or slightly above average. (*b*) They were satisfied with their achievement. (*c*) They received from 20 to 37 choices by their peers for excellent performance. (*d*) They made identical scores on the first and second administration of the personality inventory. Their scores were low on the ascendance-submission test. (*e*) Their levels of aspiration were well under

possible attainment. (*f*) They were rated as excellent and superior by their teachers.

Children who achieved below expectancy had these characteristics: (*a*) Intelligence quotients were from average to high. (*b*) They were dissatisfied with present achievement. (*c*) They were indefinite and vague about plans for the future. (*d*) They received from 0 to 3 choices by their peers as achievers. (*e*) They made high scores on the introversion-extroversion section of the inventory. (*f*) They were rated as poor, fair, and good by their teachers.

A description of a child in this category follows.

Tom entered the University Nursery School at age two and one-half years. He is an only child of parents who lost two children before Tom's premature birth. Records of the Nursery School indicated Tom's failure to develop socially acceptable behavior. The pattern of weak self-control and self-discipline continued in kindergarten and first grade. His intelligence quotient measured 165 on the Stanford Binet Form L administered by the Psychology Clinic in September, 1956. At that time, he was accelerated from first to third grade. In November, 1957, his score on the California Reading Test was 5.9. In May, 1958, his score on the same test was 7.9. He was never satisfied with his general behavior. He received three choices by his peers as one to offer assistance with a difficult assignment. He would like to be a radio announcer or a professor when he grows up. He was described by his teachers as "immature," "the class clown," "a time-waster," "one who doesn't try," and "one who has not measured up to expectancy since he has been in elementary school." The personality inventory indicated that he made a low score on the ascendance-submission test, high score on extroversion-introversion, and high score on emotional stability. Excerpts from observation notes of a research assistant give a picture of his classroom behavior.

> May 4. The children were sharing weekend experiences. Tom was talking. The class was noisy and inattentive. Some were telling him to hurry up and finish. Tom called on Mary to share next. Tom interrupted her and Mrs. C. had to interfere.
>
> May 5. Tom was looking for a book to read. He finally found one and started reading. The room was quiet. Everybody was at work. Tom started making noises with his hands. Ann, who sits next to him, asked him to stop and reported him to the teacher.
>
> May 6. Mrs. C. was talking to the class about May Day. Tom was not listening. Later, the class came in from May Day practice. Tom said he did not care to participate. Susan said that Tom pulled too

hard when they were practicing. Tom said he wanted to tell how water caused a wreck. He spent much time describing the car. He and Rita began to ask questions irrelevant to the discussion.

May 8. Mrs. C. was giving dictation for a spelling test. Tom sneezed and made the class laugh. He, then, broke his pencil point and walked loudly to the sharpener. He broke the pencil point a second time and walked more loudly than ever to the sharpener. At that place he developed hiccoughs.

On the basis of the present study the following inferences about educational achievement were made:

1. A child's achievement reflects a state of awareness or sensitivity of the organism, health, general bodily tone, ability, and a constructive attitude toward success and failure. Each child has his own achievement drive. Teacher and child should try to determine the upper limits of growth possibilities and the force and boundaries of the achievement drive. Frequent assessment reveals levels of aspiration, satisfaction, and dissatisfaction.

2. Educational achievement is influenced by many factors. There is an element of conformity in educational achievement as it is commonly measured.

3. Achievement implies a self-reference and is not understandable unless a concept of self is adopted. The achieving self will display an integrative organization of personal traits. The motives and attitudes that are central to the self persist and remain recognizable as the person advances in years. Continuous memories, dated in one's personal past, enhance the sense of identity and achievement. Educational achievement results in personality growth, integrative behavior, and a more harmonious self.

4. A child's poor performance in what is required of him may be due to a lack of basic ability or it may also reflect a lack of motivation and a lack of positive emotional involvement, taking the form of active or passive resistance. A child's performance may be inferior and savorless because of too rapid or forced growth. Ego-involvement is an important part of good teaching. Tasks appropriate to the individual, neither too easy nor too hard stimulate achievement.

5. Exaggerated straining for excellence may be regarded as power over one's environment. A power hungry individual compared to an ideal social being reveals his true social index in his relationship to others. Social achievement appears to go with a combination of unusually complete adjustment to the group and extraordinary insight.

6. Parent interest and understanding is an active force in continuous achievement. Over-protection and over-solicitation may retard the child's ego involvement and reduce the level of educational achievement.

7. Life history data constitute some of the most valid criteria of achievement, representing the actual record or substance of what a child has done and the projected outcomes of growth.

8. Further research is needed to develop techniques that probe beyond the periphery of a child's being, to determine how he feels, what purposes his behavior is serving, and what social meanings he is building from his experiences.

References

1. Aaron, I., *et al.* Fourth grade teachers experiment with cross-class grouping for reading instruction. *Elemen. Eng.,* 1959, **36**, 305-307.
2. Allport, G. Becoming. New Haven: Yale Univ. Press, 1955. Pp. 106.
3. Churchman, C. Ethics, ideals, and dissatisfaction. *Ethics,* 1952, **63**, 64.
4. Coan, R., & Cattell, R. Reproducible personality factors in middle childhood. *J. Clin. Psychol.,* 1958, **14**, 339-345.
5. Cooperative Program in Elementary Education: Some Promising Practices in Improving Elementary Schools. Athens: Univ. Georgia Press, 1959. Pp. 92.
6. Fennema, E. Mental imagery and the reading process. *Elemen. Sch. J.,* 1959, **59**, 286-289.
7. Holt, B. Effect of ego-involvement upon levels of aspiration. *Psychiatry,* 1945, **8**, 299-317.
8. Jersild, A. Child Psychology. New York: Prentice-Hall, 1954. Pp. 676.
9. McClelland, D., *et al.* The Achievement Motive. New York: Appleton, 1953. Pp. 384.
10. Maslow, A. Motivation and Personality. New York: Harper, 1954, Pp. 411.
11. Olson, W. Child Development. Boston: Heath, 1959. Pp. 497.
12. Pintner, R., *et al.* Aspects of Personality. New York: World, 1937, Pp. 8.
13. Sears, P. Problems in the investigation of achievement and self-esteem motivation: Nebraska Symposium on Motivation. Lincoln: Univ. Nebraska Press, 1957. (Pp. 265-338.)
14. Shirley, M. Children's adjustment to a strange situation. *J. Abn. & Soc. Psychol.,* 1942, **37**, 201-217.
15. Watson, G. Some personality differences in children related to strict or permissive parental discipline. *J. of Psychol.,* 1957, **44**, 227-249.
16. Whaley, F. A study of the relationships of the child as a whole at the elementary level to high school achievement and activity participation. Dissertation Abstracts, 1954, **14**, 638.
17. Winterbottom, M. The relation of childhood training in independence to achievement motivation. Dissertation Abstracts, 1953, **13**, 440-441.

College of Education
University of Georgia
Athens, Georgia

The Journal of Genetic Psychology, 1961, **98**, 203-210.

EFFECTS OF CS-US INTERVAL ON AVOIDANCE CONDITIONING OF CATS*

Department of Psychology, Brown University

ALLAN M. SCHRIER[1]

A. INTRODUCTION AND PROBLEM

Three experiments have recently been conducted on the effects of the time interval between the onset of the CS and the onset of the US on the acquisition of an avoidance response. In all three experiments, the apparatus was a modified Mowrer-Miller shuttle box and the *S*s were dogs. Kamin (5) used an intense level of shock, intervals ranging from 5 to 40 seconds, and a trace-conditioning procedure—that is, the CS terminated before the onset of the US. Kamin reported a marked and significant decrease in speed of acquisition as the CS-US interval increased. Brush, Brush, and Solomon (2) used an intense level of shock, intervals ranging from 2.5 to 80 seconds, and a delayed-conditioning procedure—that is, the CS preceded and overlapped the US. They found a significant decrease in speed of acquisition with increase in CS-US interval from 5 to 80 seconds, but the trend was considerably less marked than it was in the Kamin experiment. Although there were a number of procedural differences between the two experiments, Brush *et al.* attributed the differences between Kamin's results and their own to the former's use of the trace-conditioning procedure. In order to test this assumption, Church, Brush, and Solomon (4) repeated Kamin's experiment in all essential details, except that the range of CS-US intervals was smaller and a delayed-conditioning procedure was used. Church *et al.* found no significant relationship between speed of acquisition and CS-US interval.

The present experiment provided another test of the effects of the CS-US interval on avoidance conditioning, using the delayed-conditioning procedure. The experiment reported here differed from the previous ones in that, among other things, the *S*s were cats, a lower level of shock was used, and the intertrial intervals were shorter.

* Received in the Editorial Office on June 26, 1959.
1 This research was conducted at the California Institute of Technology and was supported by the Frank P. Hixon Fund of that institution and by N.S.F. grant No. G-3880 to R. W. Sperry.

B. Method

1. *Subjects*

Initially, nine cats were used as the *S*s. The experiment was then replicated with 15 additional cats serving as the *S*s. The latter will be referred to as the "replication *S*s." The age range of the cats was one to three years and all were experimentally naive.

2. *Apparatus*

The apparatus was a shuttle box somewhat similar to the one described by Solomon and Wynne (8). It was built primarily of wood and painted a flat black. The apparatus was 34 inches long, 19 inches wide, and 19 inches high, and was divided into two compartments by a 5-inch high, wood partition and a black, felt curtain, which hung from the ceiling of the apparatus to the top of the partition. A 40-watt lamp was housed directly above a Plexiglas-covered opening in the ceiling of each compartment. The animals were observed through a Plexiglas window, 8 inches high and 30 inches long, in one side of the apparatus. In order to cut down the animals' view of the test room, the window was covered by a fine-mesh, brass-wire screen, which was coated with flat black paint on the side viewed by *E*. The floor was a grid, consisting of a series of parallel 1/4-inch brass rods, centered 1/2-inch apart, which were wired so that adjacent ones were of opposite polarity. The grid floor of each compartment was wired to a 0-130 v. variable transformer. A rectifier-type milliammeter, with an approximate resistance of 700 ohms, was placed in series with the grid floor. As preliminary work suggested, the problem of short-circuiting because of defecation in the apparatus was practically absent. Only three of the animals defecated in the apparatus, and this occurred during pretraining when high shock levels were used. The absence of elimination in the apparatus during training was undoubtedly in part the result of the low shock level employed and in part a peculiarity of the species used.

The *E* sat at a table facing the window of the apparatus. An opaque screen, which rose to about the height of the *E*'s chin, was placed on the table to prevent the possibility of the *S*s viewing the apparatus controls on the table. The test room was illuminated by a 15-w. lamp situated about 6 feet above the table.

3. *Procedure*

a. Pretraining. Each *S* was placed in the apparatus for 20 minutes on two consecutive days, one day with the apparatus lights on, the other with the lights off. On each of the following two days, the *S*s were placed in the

apparatus for 12 minutes. Initially, the light was on in one compartment and off in the other. Every 2 minutes, regardless of the *S*s' behavior, the lighting arrangement was reversed. Total time spent in the lighted compartment during the two test days was tabulated. Shock-level determinations were made for each *S* on the fifth day of pretraining. Beginning with a subthreshold voltage level, shock was turned on in the compartment occupied by *S*. If the *S* did not cross the barrier within 20 seconds, the shock was turned off and then presented 30 seconds later with the voltage increased by 4 to 6 per cent. The voltage was increased in this manner until *S* crossed the barrier immediately upon the onset of shock on six successive trials. Voltage was then varied in successive descending and ascending series until the minimum level which would maintain consistent barrier-crossing was approximated. After all escape responses, the shock was kept on in the unoccupied compartment during the 30-second intertrial interval. It was found that the minimum effective voltage level in all cases corresponded to a meter reading of 1 to 2 ma. Three of the original *S*s and two of the replication *S*s became highly emotional during shock-level determinations, failed to learn the escape response within a reasonable number of trials, and were dropped from the experiment.

b. Experimental design. In both the original experiment and the replication, the *S*s were randomly divided into three experimental groups after the completion of the pretraining. The interval between the onset of the CS and the onset of the US was different for each group, and was either 4-, 12-, or 20 seconds. There were two *S*s in each group during the original experiment. The replication added four *S*s to both the 4-second and the 12-second groups, and five *S*s to the 20-second group.

c. Avoidance training. The *S*s in all groups were given 25 trials per day for 30 days. The intertrial interval was 25, 35, or 45 seconds with a mean of 35 seconds each day. The CS was the onset of light for all animals because no clear-cut preference for either the lighted or the unlighted compartment was found during pretraining. During the intertrial interval, light and shock were kept on in the unoccupied compartment. Although allowing for additional unsystematic practice at escape responding between trials, this aspect of the procedure was necessitated by physiological experiments which followed the present one. The frequency of barrier crossing between trials was recorded for each *S*. Another disadvantage of the procedure was that an *S* could expose itself to the CS alone between trials by putting its head through the curtain while keeping the rest of its body in the non-shock compartment. As it turned out, this behavior did not occur in the present

experiment; but did in a few cases in succeeding experiments. If an *S* failed to cross the barrier immediately upon the onset of shock on a non-avoidance trial, the voltage level was gradually raised until the animal crossed, but was returned to the original level for the following trial. If an increase in voltage level was required on any five consecutive trials or on at least five trials during two consecutive days, the voltage level was permanently raised by 4 to 6 per cent. The voltage level had to be raised during training for none of the *S*s in the 4-second group, for two of the *S*s in the 12-second group, and for two of the *S*s in the 20-second group.

Latencies of avoidance responses were determined only for the replication *S*s in the 12-second and 20-second groups. "Latency" was defined as the time interval between the onset of the CS and the removal of all four limbs from the grid floor of the compartment in which shock was impending, and was recorded by stop watch to the nearest .1 second. As measured here, then, latency included not only time taken to initiate barrier crossing but also time taken to terminate crossing.

C. Results

The major results of the experiment are summarized in Table 1, which shows the mean and median percentages of avoidance responses made by each

TABLE 1
Acquisition of the Avoidance Response as a Function of CS-US Interval

CS-US interval	Trial first avoidance response		Percentage avoidance responses Days 1-15		Days 16-30	
	Mean	Median	Mean	Median	Mean	Median
4 sec.	32	31	41	43	71	75
12 sec.	33	30	39	42	74	80
20 sec.	14	13	52	42	85	85

group during the first 15 days of avoidance training and during the second 15 days of avoidance training. Also shown are the mean and median trials on which the first avoidance response occurred. Both measures of the central tendency suggest that the *S*s in the 20-second group tended to make their first avoidance response earlier in training than did the *S*s in the 4-second and 12-second groups. With regard to the course of acquisition after the initial avoidance, the medians for the first 15 days of training indicate a similar level of performance for the three groups. The relatively large discrepancy between the mean and median for the 20-second group was due primarily to very rapid acquisition on the part of one *S* in the group. During the latter half of training, there was a direct relationship between the mean (and

median) percentage of avoidance responses and CS-US interval. However, employing the Kruskal-Wallis test (7), it was found that the group differences were not significant at either stage of practice. The differences between the groups with regard to the first-avoidance trial were also not significant.

Time of testing did not appear to influence the results. The performance of the first group of *Ss* tested did not differ reliably from that of the replication *Ss* either in terms of the trial of the initial avoidance response or the frequency of avoidance responses. The Mann-Whitney test was used here (7).

The frequency of barrier crossing between trials was very low from the beginning of avoidance training, probably the result of the procedures used during shock-level determinations in pretraining. The mean frequency for the 4-, 12-, and 20-second groups were, respectively, .4, .8, and 3.6 on Day 1, and .4, .6, and .8 on Day 2. The relatively high frequency for the 20-second group on Day 1 was due chiefly to one *S*, which crossed 16 times between trials. This *S* was among the last in the group to make the initial avoidance response. The next highest frequency for any *S* was 4. By the end of Day 2, practically all the *Ss* had learned to sit quietly in the nonshock compartment between trials. The mean frequency of crossing between trials before the first avoidance response was about the same for the three groups, excluding the *S* with the extreme frequency from the 20-second group.

In order to make a rough comparison of the speed of acquisition in the present experiment with the speed in previous experiments on dogs, the median number of trials to reach a criterion of 10 consecutive avoidance responses within any test session was computed for each group. The medians were 372, 326, and 200 for the 4-second, 12-second, and 20-second groups, respectively. The differences were not significant. In the experiment by Brush *et al.* (2), for example, the trials-to-criterion medians, with 10 trials given per day, and the criterion the same as the above, were 11, 12, and 12 for their 5-second, 10-second and 20-second groups, respectively.

The mean and median avoidance response latencies for the replication *Ss* in the 12-second and 20-second groups are shown in Table 2. These group means and medians were computed from the individual mean latencies. It appears that the avoidance response tended to occur midway during the CS-US interval. By assigning the maximum possible mean latency of 4 seconds to each *S* in the 4-second group, it was possible to statistically analyze latency scores for all three groups. The frequencies of avoidance responses for the *Ss* in the 4-second group were comparable to those for the *Ss* in the 12-second

and 20-second groups, indicating that the avoidance response could be made within 4 seconds. The Kruskal-Wallis test revealed the increase in latency of avoidance with increase in the CS-US interval to be reliable ($p=.01$). The mean latency of avoidance was also computed for each of the replication *Ss* in the 12-second and 20-second groups for the first 15 days of training and for the second 15 days. Practice had no significant effect on latency as indicated by the Wilcoxen test (7).

TABLE 2
LATENCY OF THE AVOIDANCE RESPONSE IN SECONDS

CS-US interval	*n*	Mean	Median
12 sec.	4	7.0	6.6
20 sec.	5	10.6	10.6
20 sec.	5*	10.4	10.2

* Operated animals.

Table 2 also shows the mean and median latencies for five cats trained in the shuttle box in connection with a different experiment. These *Ss* had been subjected to a partial sectioning of the optic chiasm and the corpus callosum; such an operation leaves them practically indistinguishable from normal *Ss*. [See Schrier and Sperry (6) for references to research on such animals.] They were restricted to monocular vision, but were otherwise treated in the same manner as the *Ss* in the 20-second group. Despite monocular vision and operations, their speed of acquisition was comparable to that of the normal *Ss*. It can readily be seen in Table 2 that the avoidance latencies for the operated *Ss* and the *Ss* in the 20-second group tended to be quite similar.

D. Discussion

The present findings are similar to those of Church *el al.* (4) in that CS-US interval, within the range of 4 seconds to 20 seconds, did not have a significant effect on acquisition of the avoidance response in the shuttle-box situation. Brush *et al.* (2), on the other hand, reported a significant, inverse relationship between CS-US interval and speed of avoidance learning in a shuttle box. The use of a wider range of intervals by Brush *et al.* might account for their findings. Although the effect of CS-US interval remained significant when they eliminated the two extreme groups in one of their analyses, leaving the range from 5 seconds to 40 seconds, the differences between the groups were not very striking. Furthermore, their published data reveal that within the 5-second to 20-second range, the differences were extremely small and undoubtedly not significant.

Considering the present findings together with those on dogs, one conclusion seems to be clear: Under a wide variety of conditions, variation in the CS-US interval, especially within the range of about 4 seconds to 20 seconds appears to have a small effect, if any at all, on acquisition of the avoidance response in the shuttle-box situation when a delayed-conditioning procedure is employed. Kamin's results (5) suggest that this conclusion does not apply when a trace-conditioning procedure is used. A two-factor theory that appears to account for these findings has been discussed extensively in previous papers (2, 4, 8).

Acquisition of the avoidance response was strikingly slower in the present experiment than in those on dogs. While cats may be inherently slower learners in a shuttle box than are dogs, other variations in conditions—e.g., the use here of shorter intertrial intervals and lower shock levels—may have been important. Brush found (1), in a shuttle-box experiment in which a delayed conditioning procedure was used, that a significantly greater number of dogs learned to avoid shock as shock intensity increased up to about 5 ma., but that the speed of acquisition, in the case of those *S*s that did learn, was unrelated to shock intensity. Brush has also reported an inverted U-shaped relationship between avoidance acquisition in a shuttle box and intertrial interval[2]. The optimal intertrial interval was clearly greater than one minute, which was the shortest interval used.

In the present experiment, as in the previous experiments on dogs, the latency of the avoidance response was found to be a direct function of the length of the CS-US interval. Practice had little effect on the latency, as also seemed to be the case in the experiments by Kamin and by Church *et al.* Church and Black (3) reported evidence on conditioning of heart rate in dogs which they felt supported the hypothesis, derived from the two-process theory of avoidance learning, that conditioned emotional reactions mediate the effect of CS-US interval on the latency of the avoidance response. They found that conditioned heart-rate increase showed the inhibition of delay which is a characteristic of Pavlovian conditioning, and also that its latency did not alter with practice. They pointed out that the latency of the maximum conditioned heart-rate increase was the same order of magnitude as that found for the avoidance response in the shuttle box (4, 5). The mean avoidance latency for the present 20-second group was 10.6 seconds. This value is close to the 10.9-second mean latency reported by Church and Black for the maximum conditioned heart-rate increase under a 20-second CS-US interval

[2] These findings were reported by F. R. Brush in a paper at the 1959 meeting of the Eastern Psychological Association.

and delayed conditioning procedure. The latencies in the present study were somewhat longer than those reported for dogs, but differences in definition of latency and details of apparatus—such as the use of a barrier here which was lower than those used in the dog studies and, hence, did not require a definite jump on the part of the cats—might account for the discrepancies.

E. Summary

The present experiment was designed to investigate the effects of the interval between the onset of the CS and the onset of the US on the acquisition of an avoidance response. The apparatus was a shuttle box and a delayed conditioning procedure was used. Three groups of cats were given 25 trials per day for 30 days with the CS-US interval 4 seconds for one group, 12 seconds for the second group, and 20 seconds for the third group.

The groups did not differ significantly with regard to the trial on which the first avoidance response occurred, nor did they differ significantly in the frequency of avoidance responses made during the first 15 days of training or during the second 15 days. On the other hand, latency of the avoidance response increased significantly with increase in the CS-US interval. These findings are essentially in agreement with the findings in previous shuttle-box experiments on dogs in which the delayed-conditioning procedure was employed.

References

1. Brush, F. R. The effects of shock intensity on the acquisition and extinction of an avoidance response in dogs. *J. Comp. & Physiol. Psychol.*, 1957, **50**, 547-552.
2. Brush, F. R., Brush, E. L., & Solomon, R. L. Traumatic avoidance learning: The effects of CS-US interval with a delayed conditioning procedure. *J. Comp. & Physiol. Psychol.*, 1955, **48**, 285-293.
3. Church, R. M., & Black, A. H. Latency of the conditioned heart rate as a function of the CS-US interval. *J. Comp. & Physiol. Psychol.*, 1958, **51**, 478-482.
4. Church, R. M., Brush, F. R., & Solomon, R. L. Traumatic avoidance learning: The effects of CS-US interval with a delayed-conditioning procedure in a free-responding situation. *J. Comp. & Physiol. Psychol.*, 1956, **49**, 301-308.
5. Kamin, L. J. Traumatic avoidance learning: The effects of CS-US interval with a trace-conditioning procedure. *J. Comp. & Physiol. Psychol.*, 1954, **47**, 65-72.
6. Schrier, A. M., & Sperry, R. W. Visuo-motor integration in split-brain cats. *Science*, 1959, **129**, 1275-1276.
7. Siegel, S. Nonparametric Statistics. New York: McGraw-Hill, 1956.
8. Solomon, R. L., & Wynne, L. C. Traumatic avoidance learning: Acquisition in normal dogs. *Psychol. Monog.*, 1953, **67**, No. 4 (Whole No. 354).

Department of Psychology
Brown University
Providence 12, Rhode Island

The Journal of Genetic Psychology, 1961, 98, 211-217.

THE EFFECT OF SOCIALLY LEARNED AGGRESSION OR SUBMISSION ON THE MATING BEHAVIOR OF C57 MICE*

University of Colorado School of Medicine

MARVIN W. KAHN[1]

A. PROBLEM

Fighting and mating are closely associated behaviors in many mammalian species. Ford and Beach (3, pp. 57) comment: "It is not an exaggeration to state that physically aggressive behavior forms an integral part of the sexual pattern for vertebrates of every major phyletic class, . . ." Among many male mammals dominance based on fighting would appear to help create the opportunity for heterosexual drive expression. While little is known of how aggressiveness or submissiveness affect sexual activity as such, personality theory particularly psychoanalytic (2) implies that these characteristics do affect behavior in other spheres of activity. The present study was concerned with the question of whether learned aggression and submission affect male mating behavior.

Adult male mice are known to fight "spontaneously," and it has been demonstrated (4) that aggressive or submissive social behavior can be learned and maintained by C57 mice. Beeman (1) has shown that testicular hormone are necessary to initiate fights, but castrates who have fought prior to castration often continue fighting. On the other hand unoperated males who experience early severe defeat by adult fighters are not likely to fight as adults (5).

The hypothesis tested was that socially learned aggressive and submissive behavior significantly and differentially affect the character of the mating response of C57 male mice.

B. PROCEDURE

The subjects were 10 male C57 mice who were raised in isolation from weaning at 21 days until from 60 to 70 days of age, at which time training was begun. The aggressive group consisted of three males trained to cri-

* Received in the Editorial Office on June 29, 1959.
1 This investigation was supported in part by a research grant from the Continuing Research Fund of the University of Colorado School of Medicine. The present report is based on a paper presented at the annual meeting of the American Psychological Association, Washington, D.C., 1958.

terion as fighters and the submissive group of seven males trained to criterion as submissive.

The training procedure for the aggressive males was based on the finding (8) that with easy and continued victories over helpless mice, males become increasingly vicious and likely to fight. Every other day for at least five days the aggressive animals were given the following training experience. A helpless mouse was dangled by the tail and dragged in front of the fighter three times, then the "dangler" was bumped in the back of the fighter three times and then bumped in the front of the fighter three times. At this point when the fighter would attack the dangler, the dangler was set loose and the fighter was permitted to chase and attack for two minutes. Five exposures to the dangler each training day were carried out. The criterion for a trained fighter was immediate and sustained attack on an untrained male during a five-minute test period. Practice fighting was continued beyond the criterion, at the rate of three times a week, for a one-month period.

The training procedure for the submissive males utilized the finding (8) that with continued defeat male mice become very defensive in their activities with other mice and will not fight. Males trained for this group were placed in a pen with a trained fighter mouse for a 10-minute period every other day for at least five days. They experienced continual severe attacks from these fighters. The criterion of submission was lack of aggressive response and essentially submissive behavior when placed in a pen with an untrained adult male for a five-minute period. This defeat experience was continued beyond the criterion, at the rate of three times a week, for a one-month period.

To test the hypothesis of differential mating behavior of aggressive and submissive male mice, the males were placed in a pen for a 10-minute period with a female determined to be in estrous by the vaginal smear method. These males had been first trained to the criterion and given the one month of additional experience in either fighting or in being beaten. The females were chosen randomly from a pool of 20 females, all of which were 70 to 100 days of age and were raised exclusively with other females since weaning. Vaginal smears were taken on each female until one in estrous was found. That female was used for testing of the male, the others were returned to the pool. No female was used more than once for testing.

The male behavior toward the female during the test period was recorded in terms of activities which were considered to be on a continuum from approach or contact behavior to avoidance or non-contact responses. The approach activities were classified as (*a*) *pursuing* the female, (*b*) *copulating*,

consisting of posterior mounting and pelvic thrust, (*c*) *mounting,* or raising the forepaws and chest across any part of the female, (*d*) *grooming* or running the paws or nose through the female's fur. The non-contact or avoidant activities consisted of (*e*) *nosing* or sniffing at the female from a distance, (*f*) *inactivity* or remaining immobile without apparent interest in the female and (*g*) *running away* or actively avoiding the female by retreating. The only female characteristic it was possible to consistently record was that of either pursuing or running from the male.

These behaviors were recorded in time units of one minute, for the 10-minute test period. For purposes of tabulation, the activity displayed in a given period which was closest to the approach end of the continuum, was employed. However, other activities and qualitative descriptions of behavior were also noted.

C. Results

The distribution of the highest sexual approach activity in each minute for each individual male, of each group is given in Part A of Table 1. It may be noted from this tabulation that only the aggressive group animals copulated and pursued the female, while no submissive animals did so. Conversely only submissive males were inactive. Running away and nosing were almost exclusively behaviors of the submissive group, while mounting was almost exclusively a behavior of the aggressives.

It may further be noted from Part A of Table 1 that while the aggressive males displayed sexual aggressive behavior immediately in the test period and tended to remain sexually aggressive throughout, the submissives were initially very avoidant as a whole and only after four minutes had elapsed did some contact with the female occur by the submissives. It should be noted that the submissives' contact behavior was relatively infrequent and tended to decline during the last part of the test period.

The submissive animals on the whole showed less approach or contact responses than the aggressives. This difference is significant at the .01 level of confidence, as tested by the Pearson-Lamda method (6) for combining significant tests. Such approach behavior as the submissive animals did display was significantly delayed (.01 level by the Pearson-Lamda method) as derived from Part C of Table 1.

In terms of the individual approach or avoidance behaviors, the probabilities by the Binomial method of the differences between the two groups being chance are given in Part B of Table 1. It may be noted that the aggressive animals did significantly more copulating and mounting than

the submissives, with a trend for the aggressives to do more grooming. The submissive group was significantly higher than the aggressive animals on all the avoidant behaviors.

Qualitatively, the differences in approach and avoidance behavior of the two groups were even more striking than the significance levels would indicate. Since only the highest approach behavior for each minute was recorded, considerable avoidant behavior during any one-minute period for the submissive group was not included in the tabulation. It was characteristic of the submissives that when they made any approach, they tended to do so very hesitantly and briefly, and to follow such responses by considerable avoidance. Frequently, most of a minute period was occupied by considerable avoidance in the submissive group although the animal was credited for the brief period of approach during that minute. In contrast, the aggressives characteristically tended to make approach responses continuously throughout the test period, and displayed little or no avoidance behavior at any point.

TABLE 2
DISTRIBUTION OF THE OCCURRENCE OF FEMALES PURSUING MALES AND MALES RUNNING AWAY DURING EACH MINUTE OF MATING TEST FOR A & S GROUPS

	1′	2′	3′	4′	5′	6′	7′	8′	9′	10′
Aggressive males	0	0	0	0	0	0	0	0	0	0
Submissive males	7	7	7	6	6	5	6	5	5	5
Level of significance of difference by the binomial method (2 tailed)	.016	.016	.016	.031	.031	.063	.031	.063	.063	.063

The response of the females to the two groups of males was strikingly different. The aggressive males almost immediately pursued the females and attempted mounting, and to these males the females tended to react by running away and attempting to avoid the male, at least initially. In contrast, the submissive animals made no initial approach, and within the first minute all the females tended to approach the male. The submissive males' response was to run away and the females proceeded to pursue these males quite actively. Table 2 gives the frequency of occurrence of male running away from the female approach at any time during each minute of the test period. It can be seen that the aggressive males never ran from the females and were never pursued, while almost all the submissives ran away and were pursued at some time during almost every minute of the test. The difference between the two groups in this respect is significant beyond the .01 level by the Pearson-Lamda test.

D. Discussion

The highly significant difference of response of the females to each group of males clearly interacts with male behavior. Thus, to some extent the difference in response of the males to the females was undoubtedly affected. It appears very probable that the females' tendency to flee the aggressive males may have tended to stimulate pursuit and approach behavior. On the other hand the females' advance to the submissive males probably tended to heighten the submissive animals' avoidant responses.

Sexual inhibition of the submissive animals appears clear from the data, but because of the aggressive stimuli presented by the females, interpretation is somewhat difficult. To what extent sexual inhibition was involved and to what extent the male's avoidance was a generalized fear response to any other animal or a combination of these is a matter for future investigation.

The extent to which sexual activity of the aggressive males was increased by the aggressive training or simply by a fleeing social object also needs to be further determined. Questions of the relationship of aggression and sexuality in the male mammals are certainly raised, however, by these findings.

Viewed from the standpoint of personality theory, the findings of this study do suggest a covariation between aggressiveness and sexual activity to an extent on the part of the male. The findings of Beeman (1) that the aggressiveness also covaries with castration or non-castration of males supports a suggestion that in male mice, at least, aggression and sexuality appear to be interwoven behaviors.

A possibility for future investigation suggested by this study is that some forms of aggression and sexual drive may not in fact be separate distinct drives but rather different manifestations of a common drive.

If aggressive drive and sexual drive are considered as essentially separate drives, these data would suggest that increase in aggressive response effects an increase in sexual response. Conversely, the data imply that learned inhibition of aggression (submission) effects a corresponding inhibition of sexual response. This would lend itself to an interpretation that increase or inhibition of one drive may be associated with a covariant increase or inhibition in a separate drive.

The adaptability of the female to male sexual behavior would appear to have considerable value from the point of view of survival of the species.

E. Summary

1. It was hypothesized that socially learned aggression and submission differentially affect the mating response of male C57 mice. One group was trained to be aggressive and the other to be submissive. Both groups were then tested for sexual activity by being placed in a pen with a virgin female known to be in estrous.

2. The aggressive animals showed significantly more sexual approach and contact behavior than the submissive group, as well as significantly lower latency of approach response to the female. Conversely, the submissive males were significantly more sexually avoidant and lacking in contact with the female, and significantly delayed in such contact as they did achieve.

3. The females responded in a significantly different manner to the two groups of males. The females ran from the aggressive animals and had to be pursued. In contrast, the females pursued the submissive males which in turn ran from the females.

4. It is concluded that these results confirm the hypothesis that learned social aggression and submission do differentially affect the mating response of male mice. Further the results indicate that females also react differentially in mating to aggressive and submissive partners.

5. Some implications for personality theory are considered.

References

1. Beeman, E. A. The effect of male hormones on aggressive behavior in mice. *Physiol. Zool.*, 1947, **20**, 372-405.
2. Fenichel, O. The Psychoanalytic Theory of Neurosis. New York: Norton, 1945.
3. Ford, C. S., & Beach, F. A. Patterns of Sexual Behavior. New York: Harper, 1951.
4. Ginsburg, B., & Allee, W. C. Some effects of conditioning on social dominance and subordination in inbred strains of mice. *Physiol. Zool.*, 1942, 485-506.
5. Kahn, M. W. The effect of severe defeat at various age levels on aggressive behavior of mice. *J. Genet. Psychol.*, 1951, **79**, 117-130.
6. Rao, C. R. Advanced Statistical Methods in Biometric Research. New York: Wiley, 1952.
7. Scott, J. P. Incomplete adjustment caused by frustration of untrained fighting mice. *J. Comp. Psychol.*, 1946, **39**, 379-390.
8. Scott, J. P., & Fredrickson, E. The causes of fighting in mice and rats. *Physiol. Zool.*, 1951, **24**, 273-304.

Medical Center
University of Colorado
4200 East Ninth Avenue
Denver 20, Colorado

The Journal of Genetic Psychology, 1961, 98, 219-227.

CHILDREN'S DISCOVERY OF THE CONSERVATION OF MASS, WEIGHT, AND VOLUME: PIAGET REPLICATION STUDY II*

Department of Psychology, Wheaton College

DAVID ELKIND[1]

A. INTRODUCTION

This study is the second[2] in a series devoted to the systematic replication of experiments originally performed by the Swiss psychologist, Jean Piaget. For its starting point the present study takes one of Piaget's (1940) investigations dealing with the ages at which children discover the conservation of mass, weight, and volume. Piaget assumes that concepts develop and that the discovery of conservation earmarks the final stage of their development. By studying children's responses to demonstrations of the conservation of mass, weight, and volume Piaget sought to uncover the genetic stages in the formation of these concepts. The present study differs from Piaget's investigation in its standardization of his procedures and in its use of statistical design.

In his investigation Piaget tested for the conservation of mass, weight, and volume by means of the "sausage" experiment. The purpose of this experiment was to determine whether the child could tell that a quantity remained the same (was conserved) after it was changed in appearance. For example, in testing for the conservation of mass Piaget showed the child two clay balls identical in size, shape, and weight. After the child agreed that both balls had equal clay, Piaget made one of the balls into a sausage. Then he asked the child to judge whether the ball and the sausage contained the same amount of clay. Piaget also asked the child to predict—while both pieces of clay were shaped as balls—if they would be the same were one made into a sausage and to explain his judgments and predictions.

Using the sausage experiment to test 5- 12-year-old children, Piaget found that discoveries of conservation followed a regular order that was related

* Received in the Editorial Office on July 6, 1959.
1 This study was carried out while the writer was a Staff Psychologist at the Beth Israel Hospital in Boston. The writer is indebted to Dr. Greta Bibring, the head of Beth Israel's Dept. of Psychiatry, and to the members of the research committee for granting him the time to make the study.
2 For a report of the first study cf. Elkind (1961).

to age. The conservation of mass was discovered at ages 7-8; the conservation of weight was discovered at ages 9-10; and the conservation of volume was discovered at ages 11 and 12. These findings, together with his theoretical interpretations, Piaget reported with the aid of a great many illustrative examples but without statistics.

Starting from Piaget's procedures and results the present study was designed to test the hypotheses that, other things being equal, (*a*) the number of conservation responses does not vary significantly with the Type of Response (prediction, judgment, and explanation) required; (*b*) the number of conservation responses varies significantly with the Type of Quantity (mass, weight, and volume); (*c*) the number of conservation responses varies significantly with Age Level; (*d*) the number of conservation responses varies significantly with the joint effect of Type of Quantity and Age Level (the statistical test of Piaget's age-order of discovery finding). In addition children's explanations were categorized for comparison with the explanations given by Piaget's subjects.

B. Method

1. *Subjects.*

One hundred and seventy-five children attending the Claflin School[3] in Newton, Mass., were tested. Twenty-five children were randomly selected from each of the grades from kindergarten to sixth. The mean age and standard deviation for each grade were: Kindergarten, M = 5:8, SD = 3.0; Grade 1, M = 6:8, SD = 3.9; Grade 2, M = 7:7, SD = 3.6; Grade 3, M = 8:6, SD = 3.8; Grade 4, M = 9:7, SD = 3.0; Grade 5, M = 10:7, SD = 2.5; Grade 6, M = 11:9, SD = 5.56 months. Hereafter the grades will be referred to by their age level.

For 125 children at the five oldest age levels, Kuhlmann-Anderson Intelligence Test scores were available. The mean IQ for this group was 109 and the SD was 11.0 points. Most of the children came from middle to upper-middle class homes.

2. *Procedure*

Each *S* was seen individually and questioned three times on each type of quantity. For each quantity *S* was asked first to predict, next judge, and then explain his conservation or non-conservation responses. The order

[3] The writer is grateful to the principal, Dr. Harry Anderson, and teachers of the Claflin School whose friendly cooperation made the study not only possible but enjoyable.

of the questions and the order of presenting the quantities—mass, weight, volume—was the same for all *S*s. A fixed order of presentation was used to provide a more rigorous test of Piaget's findings. Any practice effects resulting from the fixed order should have worked against the differences Piaget found. On the other hand if differences were developmentally determined, as Piaget assumes, then the minimal practice effect over a brief time span should have had little effect.

3. *Tests*

In the test for the conservation of mass, two clay balls identical in size, shape, and weight were on the table. *E*, "Do both balls have the same amount of clay, is there as much clay in this ball as in this one?" *S* was encouraged to "make them the same," if he doubted the equality of the balls. When *S* agreed that the two balls were equal *E* asked, "Suppose I roll one of the balls out into a hot dog, will there be as much clay in the hot dog as in the ball, will they both have the same amount of clay?" (Prediction question.)

After *S*'s prediction *E* actually made one of the balls into a hot dog while *S* looked on. *E*, "Is there as much clay in the ball as in the hot dog, do they both have the same amount of clay?" (Judgment question.) Then *E* asked "Why is that?" to *S*'s response. (Explanation question.)

Exactly the same procedure was used to test for the conservation of weight and volume. To test for the conservation of weight *E* asked, "Do they both weigh the same, do they both have the same amount of weight?" etc. And to test for the conservation of volume *E* asked, "Do they both take up the same amount of space, do they both take up as much room?" etc. On each test the child was initially given the opportunity to handle the balls and to add or subtract clay as he liked to "make them the same."

4. *Scoring*

Each conservation response was scored 1 and all non-conservation responses were scored zero. For each *S* there was a total possible conservation score of 9 and for each Type of Quantity and Type of Response there was a total possible score of three.

5. *Statistical Analyses*

To test for the effects of Type of Response an analysis of variance design described by Lindquist (1953, Ch. 6) was used. In this design chance differences between subjects were controlled by testing all subjects on all types of response.

To test for the separate and combined effects of Age Level and Type of Quantity a different analysis of variance design was used (Lindquist, 1953, pp. 267-273.) In this design chance differences between subjects were controlled, for the Type of Quantity variable only, by testing all subjects on all types of quantity.

C. Results

1. *Type of Response*

In his investigations Piaget used children's predictions, judgments, and explanations interchangeably as signs of conservation or non-conservation. In the present study the F for Type of Response was NS and did not approach significance. This finding agreed with Piaget's use of these three types of response as equivalent signs of conservation.

2. *Type of Quantity*

Piaget found that, other things being equal; the conservation of mass was easiest to discover, the conservation of weight was of intermediate difficulty, and the conservation of volume was the most difficult discovery of all. The F for Type of Quantity obtained in the present study was 255.55 and was significant beyond the .01 level. Individual t tests for the Type of Quantity means revealed that the mean for each type of quantity was significantly different than every other. For all subjects the average number of conservation responses given for mass was 2.08, the average number given for weight was 1.75, and the average number of conservation responses given for volume was 0.25. The order of difficulty obtained in the present study was the same as the order that Piaget observed.

3. *Age Level*

The Swiss children tested by Piaget showed that, other things being equal, their conservation responses increased with age. For the children in the present study the same held true. The F for Age Level was 14.38 and was significant beyond the .01 level. Individual t tests of Age Level means showed that the magnitude of the Age Level means increased significantly with age in agreement with Piaget's finding.

4. *Type of Quantity-Age Level Interaction*

Piaget's illustrative examples indicated that age group differences varied with the type of quantity in question. For mass there was a marked difference between the 5-6 and the 7- 12-year-old groups; for weight there

was a marked difference between the 5-8 and the 9- 12-year-old groups; and for volume there was a marked difference between the 5-10 and the 11- 12-year-old groups in their number of conservation responses.

In the present study the variations in the differences between age groups for each type of quantity appeared as the interaction effect of Type of Quantity and Age Level. This interaction F was 6.93 and was significant beyond the .01 level. Individual *t* tests for age group differences showed that: (*a*) For mass the 5-6 and the 7- 11-year-old groups differed significantly; (*b*) for weight the 5-8 and 9- 11-year-old groups differed significantly; and (*c*) for volume the 5-10 and the 11-year-old groups differed significantly from each other in number of conservation responses given. These findings agreed with expectations based on Piaget's results.

In Piaget's early studies (1951a) he assigned different tests to the age level at which the per cent passing was 75[4]. Although he gave no percentages for the conservation experiments one can assume that he used the same criterion for assigning the conservation of mass to ages 7-8; the conservation of weight to ages 9-10; and the conservation of volume to ages 11-12. The results of the present study were converted into percentages for comparison with Piaget's criterion and these are presented in Table 1.

TABLE 1
PER CENT[a] OF CONSERVATION RESPONSES FOR MASS, WEIGHT, AND VOLUME AT SUCCESSIVE AGE LEVELS
(N = 25 at each Age Level)

Type of quantity	Age level 5	6	7	8	9	10	11
Mass	19	51	70	72	86	94	92
Weight	21	52	51	44	73	89	78
Volume	0	4	0	4	4	19	25

[a] Of 75 possible responses.

Table 1 shows that the 70 per cent point for mass was reached at the seven year level but that the 75 per cent point was not reached until age nine. For weight the 73 per cent was reached at age nine and the 75 per cent point by age 10. In this study the 75 per cent point for volume was not reached at the 11 year level.

The slight discrepancies between Piaget's results and those in Table 1 for weight and mass could easily be due to the small size of the samples used in the present study. The relatively low number of conservation responses

[4] For a test oriented approach to the replication of Piaget's work cf. Laurendeau & Pinard (1957).

at the 11 year level may be due to the fact the Piaget used a somewhat different procedure in his test for the conservation of volume. Piaget had his subjects say whether the ball and the sausage would displace the same amount of water. As a check the same procedure was used with some of the subjects of the present study (after the other testing was completed) and conservation seemed easier to discover by means of the displacement problem.

5. *Children's Explanations*

When Piaget interpreted the results of his investigation he made use of children's explanations without categorizing or quantifying them as he did in early studies (Piaget, 1951a). In the present study four types of explanation were distinguished. Two of these were explanations of non-conservation: (*a*) Romancing (Piaget, 1951b, introd.), it's more because "My uncle said so;" (*b*) Perceptual, it's more because it's, "longer, thinner, thicker, wider, etc." The two types of explanation given for conservation were: (*c*) Specific, "You didn't add any or take any away," "You can roll it back into a ball and it will be the same," and "The hot dog is longer but thinner so the same;" (*d*) General, it's the same because "No matter what shape you make it into it won't change the amount." Table 2 shows the per cent for each type of explanation given at each age level.

TABLE 2

PER CENT FOR EACH OF FOUR TYPES OF EXPLANATION GIVEN AT SUCCESSIVE AGE LEVELS (N = 25 at each Age Level)

Type of explanation	Age level						
	5	6	7	8	9	10	11
Romancing[a]	4	3	7	7	0	1	0
Perceptual[a]	85	64	53	57	36	32	33
Specific[b]	11	33	40	36	60	51	49
General[b]	0	0	0	0	4	16	18

[a] Explanation of non-conservation.
[b] Explanation of conservation.

Table 2 shows that Romancing and Perceptual explanations decrease with age while Specific explanations first increase and then level off with age. Piaget noted the same types and age trends in the explanations given by his subjects. The explanations are one type of evidence Piaget takes for his theory that as the child's thinking develops, it frees itself from its earlier domination by immediate perception. One step in this liberation is the interpretation of a perceptual effect as the result of a specific action which can be reversed (you can roll it back into a ball). A later step is to interpret a perception as but one of a great many possible instances (no matter what

shape you make it into it will always be the same). The results in Table 2 agreed with the observations upon which Piaget builds his theory of the developmental changes in the relation between thought and perception.

D. Discussion

The results of the present study agreed with Piaget's findings regarding the ages at which children discover the conservation of mass, weight, and volume. In both studies: the conservation of mass did not usually appear before the ages 7-8; the conservation of weight did not usually appear before the ages 9-10; and the conservation of volume did not in most cases appear before the age of 11. The discussion will briefly summarize Piaget's interpretation of these results.

Piaget's theory[5] is that concepts of quantity develop in three stages with the final stage ear-marked by the discovery of conservation. Children at the first stage have only a general impression of quantity but are capable of judging crude weight, volume, and mass differences. In the sausage experiment they give non-conservation responses because to their general impression the sausage is different than the ball. When they are forced to break down this impression, by the explanation question, then they judge quantity by single dimensions which they are unable to coordinate one with the other.

Those children who are at the second stage have a differentiated impression of quantity and are unable to judge quantity differences two by two (long-wide, long-narrow, etc.) which Piaget calls *logical multiplication*. Children at this stage give non-conservation responses in the sausage experiment because to their differentiated impression the sausage is both more (in length) and less (in width) than the ball. They are unable to resolve the contradiction, as one child expressed it, "It's more and it's less, I'll take one of each." When these children are forced to explain their non-conservation answers they also judge quantity by single dimensions.

At the third stage children have an abstract quantity concept and judge quantity in unit terms. In the sausage experiment they immediately predict and judge conservation. Their explanations indicate either that the perceived transformation can be cancelled (the sausage can be rolled back into a ball) or that the perceived differences can be equated (what the sausage gained in length it lost in width) and therefore the quantity is the same.

According to Piaget the *equation of differences* results in the formation of ratios and fixed units and underlies abstract quantity and number (Piaget,

[5] For more complete presentations of Piaget's theory cf. Piaget (1950; 1957; 1958).

1952) concept formation. On the perceptual plane the equation of differences enables the child to discover that an object which changes in appearance can still be the same in quantity. Piaget's theory is that once conservation is discovered it is immediately externalized and the subject has the impression that conservation is a perceptually given property of the object.

The initial appearance of the conservation of mass at ages 7-8 Piaget attributes to the development by that age of logical multiplication and equation of differences which he speaks of as *mental operations*. The time lag before the discovery of the conservation of weight at ages 9-10 and the even greater lag before the conservation of volume at ages 11-12 Piaget attributes to the quantities themselves. He argues that a quantity is difficult to conceptualize, and so to conserve, to the degree that it is associated with the subject's own action. Length, for example was more easily dissociated from the child's action than was weight. In Piaget's theory, therefore, the discovery of conservation is limited both by the maturational level of the subject and by the properties of the object and in this sense it is both a nature *and* a nurture theory.

E. Summary

One hundred and seventy-five children were asked to predict, judge, and explain the conservation of mass, weight, and volume in a systematic replication of Piaget's investigation. Analysis of variance showed that the number of conservation responses varied significantly with: Age Level; Type of Quantity; Age Level-Type of Quantity Interaction; but not with Type of Response. Romancing and Perceptual non-conservation explanations decreased, while Specific and General conservation explanations increased, with age.

The results were in close agreement with Piaget's finding of a regular, age related order in the discoveries of the conservation of mass, weight, and volume. Briefly presented was Piaget's theory that quantitiy concepts develop through three stages with the final stage ear-marked by the discovery of their conservation.

References

1. Elkind, D. The development of quantitative thinking: A systematic replication of Piaget's studies. *J. Genet. Psychol.*, 1961, **98**, 37-46.
2. Inhelder, B., & Piaget, J. The growth of logical thinking from childhood to adolescence. New York: Basic Books, 1958.
3. Laurendeau, M., & Pinard, A. Une methode rationelle de localization des testes dans echelles d'age. *Canad. J. Psychol.*, 1957, **11**, 33-47.

4. LINDQUIST, E. F. Design and Analysis of Experiments in Psychology and Education. Cambridge, Mass.: Riverside, 1953.
5. PIAGET, J., & INHELDER, B. Le development des quantites chez l'enfant. Paris: Delachaux and Niestle, 1940.
6. PIAGET, J. The Psychology of Intelligence. London: Broadway, 1950.
7. ———. Judgment and Reasoning in the Child. London: Routledge, 1951.
8. ———. The Child's Conception of the World. London: Routledge, 1951.
9. ———. The Child's Conception of Number. London: Routledge, 1952.
10. ———. Logic and Psychology. New York: Basic Books, 1957.

Department of Psychology
Wheaton College
Norton, Massachusetts

The Journal of Genetic Psychology, 1961, 98, 229-237.

AN INVESTIGATION OF AUDITORY FIGURE-GROUND PERCEPTION*

Department of Speech, Northern Illinois University

LOUIS LEREA[1]

A. INTRODUCTION

This study was undertaken with the intent of reexamining the inference that auditory figure-ground perceptual disturbances are generally evident among brain-injured individuals. Figure-ground perception is fundamental to all organized sensory behavior and has reference to the process of selectively abstracting certain salient sensations (figure) from the multitude of less relevant stimuli (ground), both impinging upon a sensory system.

Goldstein (1) has offered the broadest conceptualization of this perceptual phenomenon. He suggested that the ability to differentiate foreground from amorphous background is operant not only in the sensory field, but in the motor and ideational areas as well. Of necessity, the present investigation was focused upon the auditory figure-ground perception.

Winchester and Hartman (8) conducted an experiment in which dysphasic adults and a matched group of normal subjects were presented with words in isolation, followed by a second situation in which words and noise (hum) were given simultaneously. These researchers reported that the background noise served to interfere with the dysphasic groups' ability to repeat the signal word. They concluded that an auditory figure-ground disturbance was characteristic of adult dysphasics.

This auditory perceptual aberration also was demonstrated with brain-injured children. Werner and Bowers (5) presented exogenous and endogenous children a series of 17 simple piano melodies composed of five or six different tones. The etiological term exogenous denotes a condition of mental retardation due to cerebral insult; individuals classified as endogenous are included in the familial mental retardate category. The subjects in both groups were instructed to sing the melodies, and the accuracy of their reproductions was judged by music teachers. These researchers discovered that the vocal performances of the exogenous children were

* Received in the Editorial Office on July 10, 1959.
1 The writer wishes to express his appreciation to Mr. Peter Dieter and the staff of the Dixon State School for their assistance.

inferior to those of the endogenous subjects and therefore assumed that the brain-injured demonstrate bizarre auditory-motor behavior.

In the interest of completeness, mention should also be made of those clinical studies concerned with figure-ground perception of exogenous children exposed to separate visual and tactual-motor tasks. A marble board test, designed to evaluate the brain-injured child's ability to duplicate abstract visual figures which were imposed upon an integrated background, was employed by Werner and Strauss (6). They indicated that 84 per cent of the pathological group were unable to ignore the background, whereas only 15 per cent of the normal children's performances deviated similarly. These writers inferred that a cerebral insult affected the individual's ability to view accurately normal foreground-background relationships. Corroborating results were obtained by Werner and Strauss (7), when they exposed brain-injured children to a tactual-motor test. The figures of a triangle, a square, and an oval were outlined with semispherical rubber tacks which were fixed within a background of flat enamel tacks. The clinical and normal groups were instructed to draw the figure, following a tactual experience with each of the three forms. Again, the performances of the exogenous subjects reflected figure-ground confusion. To summarize the cursory review of the auditory, visual, and tactual-motor behavior of subjects suffering from cerebral insult, clinical research seems to support the postulate that a causal relationship exists between perceptual aberrations and brain-injury.

Mindful of the hazards inherent in the application of results derived from animal and other tangential research, the work of comparative and physiological psychologists, nevertheless, has uncovered significant material relevant to the present investigation. Hebb (2) contends that, although much that is ascribed to perception may be a function of learning, the ability to organize foreground and background is intrinsically primitive and independent of experience. To substantiate this belief, he reared rats in complete darkness. When the animals were exposed to a black and white maze, they demonstrated good visual differentiation. Effective visual figure-ground perception was also apparent in Riesen's (4) experiments, in which he reared two chimpanzees in darkness, and then presented the two animals with tasks requiring visual discrimination. Osgood (3) mentions Senden's monograph in which the latter compiled clinical reports of congenitally blind patients restored to vision, after surgery for cataracts. Despite the methodological weakness of the case history evidence recorded in Senden's

paper, there is the implication that figure-ground perception is native, insofar as these patients reported seeing "whole" objects following surgery.

An incisive comparison of the experiments enlisting brain-injured subjects and those employing animal or peripherally handicapped subjects is admittedly untenable. Nevertheless, even a perfunctory review of these studies reveals a fundamental contradiction. If simple figure-ground perception is innate, as the psychologists have reported, then is it not improbable that a cerebral injury would dislodge this native function? In the clinical situation, dysphasic and other brain-injured patients retain many sophisticated skills following cerebral damage. This is evident from their ability to engage in automatic speech and other forms of learned behavior. Why, then, should the brain injury disturb the primitive function of figure-ground perception and permit the less stable learned skills to remain relatively unmolested? One facet of this question was considered in this investigation. More specifically, the purpose of this study was to determine whether comparable groups of exogenous and endogenous subjects perform differently in an auditory figure-ground situation.

B. Method

1. *Subjects*

Twenty-five familial and an equal number of brain-injured mental retardates residing at the Dixon State School participated in this investigation. These subjects were free of speech problems and matched in age and intelligence. The mean ages for the endogenous and exogenous groups were 18.5 and 19.2 respectively; the mean intelligence quotients were 65 and 63, as determined by the Wechsler Intelligence Scales for Children and Adults. The diagnoses of familial and brain-injury were established by the medical staff affiliated with the hospital at the Dixon State School.

Prior to the actual experiment, each subject was administered a pure tone sweep test with the Beltone 10-A audiometer. An individual was disqualified from serving in this investigation if he failed to respond to two frequencies within the speech range at 15 decibels in the better ear.

2. *Procedure*

This study was designed so that 15 judgments could be obtained under a figure-ground listening condition. The problem of securing relevant quantitative data regarding figure-ground differentiation demands certain experimental provisions. One consideration is to insure that results derived from responses to figure-ground relationships must not be confounded

with a more basic inability to perceive figures in isolation. Characteristic of many brain-injured patients is their apparent difficulty in reception and expression of language or other abstract symbols. Since this investigation attempted to assess auditory perception among brain-injured subjects, it seemed desirable to discard words or other meaningful sounds which would require, in addition to perception, a high degree of cognition. The syllable format, therefore, was used in this investigation in preference to words because: (*a*) syllables possess a lower association value than other verbal signals and (*b*) syllables have been considered as the psychological elements of language.

Provision also was made to include a control condition in which the subjects would undertake a simple auditory-figure (isolated syllable discrimination) test. The experimenter presented both groups with tape recorded syllable pairs, and each subject was requested to determine whether the two consonant-vowel utterances were the same or different. Again, since this study was interested in perception alone, caution was taken to permit the individual sufficient opportunity to make his decisions. Eight seconds were allowed for each evaluation and two-second intervals separated each member of the paired syllables. The experimenter signaled the subject three seconds before another set of syllables was to be presented.

The individual communicated his discriminal judgments to the experimenter in a manner that was simple and flexible. If the subject believed a stimulus pair was the same, he pointed to two red blocks or nodded; to signify that the syllables were different, he was instructed to point to the red and a yellow block or shake his head.

The experimental condition consisted of an auditory figure-ground listening situation. In this situation, the subject heard a consonant-vowel combination (foreground) superimposed upon a sample of unintelligible connected speech (background). Immediately following this standard presentation, a series of three sounds were offered. These were: (*a*) the standard background of connected speech, (*b*) the standard foreground or syllable combination with the addition of a white noise background, and (*c*) the standard background with a different syllable combination. A four-second time lapse was admitted between the standard presentation and the three ensuing choice foils; two seconds separated each of the three foils. The subject indicated his "forced choice" by pointing to one of three differently colored cards bearing the numbers 1, 2, and 3, corresponding to each of the foil presentations. The two tests were tape recorded at a constant intensity level and presented via an Ampex recorder and speaker system. The listen-

er was seated comfortably at a table, and a Scott Sound Meter, Model 506, was utilized to control the general intensity level of the test items. The sensation level of the auditory stimuli at the subject's chair was approximately 60 decibels. The two listening situations were counterbalanced and given consecutively with a period of rest between each session. The tests were administered in a quiet, partially sound treated room. To supplement the instructions, the listener was given a sequence of three practice items before each condition.

3. *Equipment*

A qualified electronics engineer utilized a four channel Ampex recorder, a white noise generator, and audio-mixer, and an electronic switch in the preparation of the electronic tapes. The equipment employed is diagramed in Figure 1.

In the recording of the simple auditory-figure discrimination task, the experimenter read the syllable pairs which were recorded with the Ampex

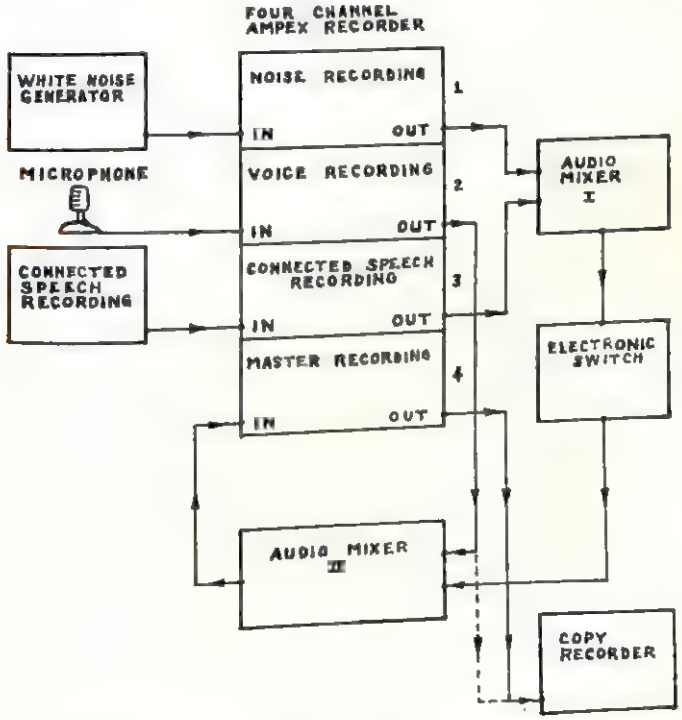


FIGURE 1
A Representative of the Equipment Utilized in the Construction of the Auditory Figure and Auditory Figure-Ground Test Tapes

recorder at a speech of 15 ips. Special care was taken to monitor all syllable utterances so that the taped signals were of equivalent loudness. With the aid of a VU meter, the speaker practiced reading the syllable lists, attempting to give equal stress to all sounds. After the master test tape was completed, the 15 items were randomized, and copies were made of the tapes.

To complete the tape recordings for the auditory figure-ground condition, it was necessary to prepare separate background stimuli of connected speech and white noise. Two voices, simultaneously reading passages of factual material, were recorded. This material was then re-recorded on a second channel of the Ampex. The contents of both channels were relayed to the third with a one-tenth of a second time delay, so that the resultant effect was a sample of connected speech with no word being clearly distinguishable.

A white noise generator was used to secure recorded segments of white noise at a level of —10 VU. This level was considered adequate in fulfilling the requirements for a background noise.

The auditory figures or syllables were taped on the number two recording channel in the same manner as described in the preparation of the syllable discrimination test. After completing the three recordings of connected speech, white noise, and syllables, the master recording was then prepared.

The background stimuli were fed to an audio mixer so that either the connected speech or the white noise could be selected as desired by a simple adjustment. The output of the mixer was relayed to the electronic switch which permitted the engineer to control the time segments of background noise to a period of two seconds. The syllables and the noise recordings were transferred to a second mixer and relayed again to the master recording channel. Each syllable utterance recorded on the master channel was centrally positioned within the background noise.

As was previously mentioned, the white noise recording output was set to a level of —10 VU, yielding a total signal to white noise ratio of 20 VU, or in absolute units, 10/1. The connected speech recording was set at an average level of —2 VU and played back at a level of —10 VU with a resultant effect of —12 VU or a signal to connected speech ratio of 4/1. These levels were arbitrarily selected to provide for clearly distinguishable syllables and noises. The standard items and accompanying foils were randomized from the master tape. Copies of the tape were played to a group of five university students for purposes of evaluating the degree of difficulty of the test items and to ascertain whether the syllables and noises

were subjectively judged to be in true figure-ground relationship. With but few exceptions, all items were correctly identified. The students agreed that both figure and ground were easily perceptible, and that the syllable combinations seemed more prominent than the noises.

C. Results and Discussion

A summary table of the pertinent statistical computations derived from the responses of the two clinical groups in the simple auditory figure and more complex auditory figure-ground conditions is given in Table 1.

TABLE 1
Summary of the *t*-tests Between Means of the Endogenous and Exogenous Groups in the Two Listening Situations

Conditions	Groups	Means	Mean diff.	Standard error	t
Auditory Figure	Endogenous	11.08	0.52	0.51	1.02
	Exogenous	10.56			
Auditory Figure-ground	Endogenous	7.68	1.56	1.11	1.40
	Exogenous	6.12			

The means obtained for the endogenous groups in the two listening tests were slightly greater than those computed for the exogenous subjects. The inconsequential mean difference between the two groups in the auditory figure situation indicated that the clinical groups were essentially similar in their ability to discriminate between the paired syllable figures. The *t*-test for related measures again yielded a negligible *t*-score in the auditory figure-ground condition. This quotient should probably be attributed to chance, since a *t*-value of 2.01 would be required for significance at the .05 per cent level.

The failure of the mean difference to achieve significance in the experimental condition is in sharp disagreement with those clinical studies reporting marked disparity between the listening behavior of brain damaged subjects and their matched groups. It would appear from the present investigation that the association of brain-injury and auditory figure-ground disturbances is not always justifiable. Moreover, the assumption that perceptual disorders are causally related to cerebral insult probably requires some qualification.

Methodological and procedural factors may have been responsible for the present failure to corroborate the inference that auditory figure-ground perceptual handicaps are symptomatic of brain-injury. Previous researchers,

concerned with the clinical implications of this sensory phenomenon, employed words and melodies as foreground stimuli. These signals are relatively complex when compared with the elemental syllable utterances used as figures in this investigation. One could reason from this, that figure-ground disturbances become apparent only when the stimulus foreground is intrinsically abstract. That is, the degree to which a noise trespasses upon the integrity of a signal may be a function of the level of abstractness of the signal. This interpretation could be experimentally verified by presenting a group of brain-injured patients with auditory stimuli of increasing complexity in conjunction with a uniform noise background. The threshold at which a patient begins to evidence perceptual disorientation would provide one index of his receptive impairment.

Conversely, the degree to which the background interferes with the recognition of the foreground is undoubtedly related to the type and intensity of the background. It would be of considerable clinical significance to assess the signal to noise ratio at which the brain-injured individual manifests perceptual distortion, when a uniform foreground and a background of varying difficulty are presented simultaneously.

Perhaps another explanation for the non-significant data obtained here is the prescribed manner in which the individuals in this study signified their responses. Since this investigation was concerned with auditory perception, the subjects were encouraged to respond by simple gestures. Past research, concerned with the perception of the brain-injured, directed subjects to demonstrate their ability to discriminate between figure and ground by producing a facsimile of the figure. It is conceivable that the brain-injured person may be capable of differentiating foreground from background, and yet be incapable of communicating this to the experimenter. Many normals enjoy the melody of a musical selection, but are unsuccessful in their attempts to sing or reproduce that melodic sequence.

Still a third factor may have contributed to the performances of the exogenous subjects involved in this investigation. Clinicians have observed that latency of response is sometimes erratic among the brain-injured. This symptom could underlie what may appear to be deviant perceptual behavior. An aphasic may respond incorrectly to a directive, not because he is unable to comply with the instructions, but because he requires more time to react. Cognizant of the contaminating effects of this symptom, the two clinical groups participating in this study were permitted ample opportunity to respond to the test items. Other investigations, on the other hand, are not explicit with regards to the time interval allowed for a response. If,

in these studies, the period between stimulus and response was minimal, then inferior performances could more accurately be attributed to reaction time rather than to a receptive disability. The impaired responses of the brain-injured should not be categorically assigned to a perceptual handicap without first ruling out other interacting forces that may be responsible for the inferior behavior. In any case, this study indicated that the concept of figure-ground distortion as applied to brain-injured individuals, is in need of clarification.

D. Summary

The present investigation attempted to explore the auditory figure-ground perceptual abilities of endogenous and exogenous individuals. Each subject was presented with syllable utterances and two noise backgrounds—connected speech and white noise. The data obtained seemed to suggest that a more complete investigation of brain injury and the supposed relation between auditory figure-ground distortion seems warranted. Avenues for more fruitful experimental and clinical exploration were discussed.

References

1. Goldstein, K. Language and Language Disturbances. New York: Grune & Stratton, 1948.
2. Hebb, D. O. The innate organization of visual activity: I. Perception of figures by rats reared in total darkness. *J. Genet. Psychol.*, **51**, 101-126.
3. Osgood, C. E. Method and Theory in Experimental Psychology. New York: Oxford Univ. Press, 1953.
4. Riesen, A. H. The development of visual perception in man and chimpanzee. *Science*, 1947, **106**, 107-108.
5. Werner, H., & Bowers, M. Auditory-motor organization in two clinical types of mentally deficient children. *J. Genet. Psychol.*, **59**, 85-99.
6. Werner, H., & Strauss, A. A. Causal factors in low performance. *Am. J. Ment. Def.*, 1940, **45**, 213-218.
7. ———. Pathology of figure-background relation in the child. *J. Abn. & Soc. Psych.*, 1941, **36**, 236-248.
8. Winchester, R. A., & Hartman, B. T. Auditory dedifferentiation in the dysphasic. *JSHD*, 1955, **20**, 178-182.

Department of Speech
Northern Illinois University
DeKalb, Illinois

The Journal of Genetic Psychology, 1961, 98, 239-245.

THE RESPONSIVENESS OF RHESUS MONKEYS TO MOTION PICTURES*

Department of Psychology, University of Chicago

ROBERT A. BUTLER[1]

A. INTRODUCTION

Over 25 years ago, Klüver (1, pp. 305-306) suggested that a study of monkeys' responses to motion pictures could provide interesting and valuable information about their emotional and perceptual world. He exposed several species of monkeys to motion pictures and observed their reactions. There was little or no behavioral evidence indicating that a Lemur and a Java monkey were attending to the film and Klüver was doubtful whether spider monkeys and squirrel monkeys were responding selectively to the motion pictures. The reactions of Cebus monkeys, on the other hand, indicated that they were attending to the projected images. One animal displayed unmistakable signs of fear when a large African Python appeared on the screen. Another reacted similarly when confronted by a close-up of a lion.

The preliminary experiments to be reported here were designed to furnish information on the responsiveness of rhesus monkeys to motion pictures. In Experiment I, the amount of time spent viewing a motion picture was compared to that recorded for static visual displays. In Experiment II, monkeys were shown a series of motion pictures which were projected both in focus and out of focus. Here, the purpose was to find out whether clarity of the projected images is an important variable for maintaining responsiveness to this type of visual display.

B. METHOD

1. *Subjects*

Eight rhesus monkeys participated in Experiment I. Four of the animals used in the first experiment were available for testing in Experiment II.

2. *Apparatus*

The apparatus consisted of a stand supporting a 2 × 2 × 2 foot aluminum box which, in turn, had a small spring-loaded door located at its

* Received in the Editorial Office on July 17, 1959.
1 This study was supported in part by a research grant, G4847, from the National Science Foundation.

front. The *S*s entered the box through a vertically sliding door. A series of holes were located in the roof of the box and a 15-watt lamp was fixed immediately above so as to provide illumination within. To reduce the illumination level, a dark green Plexiglas filter was inserted between the lamp and the box. Lastly, a light-proof shield encased the top and sides of the lamp.

The door at the front of the box opened into a cubicle, 2 feet wide, 2 feet long, and 6-½ feet high. An area 1 foot square was cut out of the cubicle wall opposite the door of the box and a sheet of lucite was inserted. One surface of the lucite sheet was matted, thereby providing a suitable screen upon which to project the visual incentives. A rear projection technique was used with the projection equipment being placed in an adjacent room. The visual stimuli were projected through a one-way mirror. Since the projected beam was confined to the 1 square foot screen, the stimuli were clearly visible even though the mirror reflected most of the light from the projection lamp.

3. *Testing Materials*

a. Experiment I. The visual incentives used in Experiment I were: (*a*) a 16 mm. motion picture, in color, showing a male and a female rhesus monkey together in a large, wired enclosure. During filming, the animals engaged at one time or another in eating, sex, threatening the photographer, and climbing on the wire netting; (*b*) colored 35 mm. slides of the same animals participating in each of the four behaviors listed above; and, (*c*) light emanating from the slide projector lamp when no slide was inserted. For the control condition, the room remained dark. The level of illumination within the box was sufficiently low to insure, for practical purposes, a near absence of light upon the screen when *S*s opened the door during the control condition. The room housing the projection equipment also remained darkened when *S*s were being tested under this condition. No attempt was made to equate the light intensities for the motion picture, photograph, and the homogeneously illuminated screen conditions.

b. Experiment II. In the second experiment, the *S*s were shown four motion pictures in the following order: Film A—"Social Behavior of the Rhesus Monkeys," Film B—"Indian Whoopee" (a Woody Woodpecker animated cartoon), Film C—"Behavioral Characteristics of the Rhesus Monkey," and Film D—"Snakes."

4. *Procedure*

a. Experiment I. The design of Experiment I was based on a 4×4 Latin square with rows representing animals, columns representing test

sessions, and Latin letters representing incentive conditions. Two *S*s, one adult, one adolescent, were assigned to each row. The animals were tested once a day, four days a week for four consecutive weeks. With regard to the incentive condition employing slides, each *S* received a different photograph on each of the four occasions when this condition applied. The order of presenting the various photographs was counterbalanced for both the adolescent and the adult groups. The length of a test session was set at 13.25 minutes coincident with the running time of the film. Testing commenced approximately 30 seconds after *S* had entered the box.

b. Experiment II. Each film was presented for four consecutive days with three days elapsing before the next film was shown. On two of the four days, the film was projected in focus. For the other days, the film was projected grossly out of focus; viz., the lens was set at a measured focal distance of 23 inches whereas the actual distance from the lens to the screen was 63 inches. In this way, continuously changing visual stimuli could be projected without apparent figure-ground relations. When *E* viewed the films projected in this manner, no ocular discomfort was noticed probably because these amorphous visual displays failed to compel the viewer to attain better visual clarity.

For each film, the in and out of focus presentation followed an ABBA sequence for two *S*s and a BAAB sequence for the other two. The running time of the films ranged from 9.25 minutes to 20.33 minutes.

The monkey's initial response to the door activated a running time meter and served as the signal for starting the projector. The projector then ran continuously for the duration of the test session.

In both Experiments I and II, the total number of door opening responses and the total length of time the door was held open were recorded automatically. The recording equipment was located in the projection room.

C. Results

1. *Experiment I*

Seven of the eight monkeys spent most time viewing the motion picture. Six animals spent least time looking out of the box during the control condition. That animal which failed to be most responsive to the motion picture was the least responsive of all the *S*s to any of the incentive conditions.

During a 13.25 minutes test session, the door was held open for an average of 6.0, 3.4, 3.3, and 2.3 minutes for the motion picture, photograph,

homogeneously illuminated screen, and control conditions, respectively.[2] A variance analysis showed that differences among conditions were significant beyond the .05 confidence level. The mean time spent viewing the motion picture differed significantly ($p. < .05$ from those recorded for the other incentives as measured by Tukey's "Gap" Test (2).

Number of door openings was approximately the same for all conditions, with mean response frequency per test session being 21.0 for the motion picture, 18.9 for the photographs, 22.2 for the illuminated screen, and 17.1 for the control condition. The way in which the various conditions differentially influenced performance was in terms of the response duration; i.e., the length of time the *S*s held open the door once they had responded to it. Mean response duration was 17.1 seconds when the motion picture was being projected as compared to 10.6, 9.0, and 8.0 for the photographs, illuminated screen, and control conditions, in that order.

Although the animals viewed four different photographs during the course of the experiment, performance was not affected differentially by changes within the photograph condition. A Friedman Chi-Square test on total viewing time for each photograph failed to reach significance at the .05 confidence level.

2. *Experiment II*

All *S*s used in these series of tests had demonstrated a greater responsiveness to the motion picture that was shown in Experiment I than they had to another of the other incentive conditions.

With respect to the present experiment, the performances of one of the monkeys failed to indicate that it was discriminating between the incentive conditions. This *S* was extremely active in the test situation with response frequencies to the door far exceeding those recorded for the other animals. In addition, response durations were consistently brief (approx. 5 seconds) irrespective of the particular film being shown and its manner of presentation.

The performances of the remaining monkeys are shown in Table 1. The data are presented in terms of the ratio of total viewing time to total testing time. This ratio is listed for each film on both the in-focus and out-of-focus conditions. On the motion pictures of monkey behavior (Films A and C), each *S* spent more time viewing the film in focus than when out of focus. These *S*s were also more responsive to the animated cartoon (Film B), when

[2] At the completion of the experiment, four of the *S*s were given two tests each on the illuminated screen condition and the photograph condition. The illumination level at the door of the box was made the same for both conditions. Again, no differences in performance between the two conditions were apparent.

shown in focus rather than out of focus. With one exception (Monkey No. 301, Film A), the greater responsiveness to Films A through C, when projected properly, was expressed more strikingly through longer response durations rather than through higher rates of door opening responses. Mean response duration was 40.2 seconds for the in-focus conditions as compared to 21.0 seconds for the out-of-focus conditions. Mean response frequency was 30.6 and 25.6 for the in-focus and out-of-focus conditions, respectively.

TABLE 1
THE PROPORTION OF TOTAL TESTING TIME SPENT VIEWING THE FILMS

Animals	Films A		B		C		D	
	+	—	+	—	+	—	+	—
301	.46	.31	.56	.25	.91	.56	.66	.50
312	.76	.38	.58	.24	.88	.41	.87	.20
313	.63	.15	.15	.04	.65	.02	.01	.08

A—Movie depicting social interaction of rhesus monkeys living in a semi-natural environment; running time 22.33 minutes. *B*—Animated cartoon in color; running time 22 minutes, achieved by reversing the direction of the film periodically. *C*—Movie showing behavior of individual monkeys living in a semi-natural environment; running time 9.33 minutes. *D*—Movie showing behavior of various species of snakes; running time 10.33 minutes. The symbol "+" represents in-focus condition and the symbol "—" represents out-of-focus condition.

Film D, the film on snakes, was selected for its possible adversive characteristics, yet Monkey 312 maintained nearly continuous visual contact with the film when it was shown in focus. In contrast, the performance of Monkey 313 was suppressed. This animal responded only once each time the film was presented clearly, whereas it gave a total of 11 responses when the film wans not in focus. Monkey 301, unlike its performances on the preceding films, exhibited an inordinately high rate of door opening responses when Film D was correctly focussed, but it held the door open only a brief interval for each response. The mean response duration for each film when shown in and out of focus is listed in Table 2. When comparing the performances of Monkeys 301 and 313 on Film D with those per-

TABLE 2
MEAN RESPONSE DURATION (MINUTES)*

Animals	Films A		B		C		D	
	+	—	+	—	+	—	+	—
301	.23	.26	.36	.19	.61	.34	.06	.25
312	3.09	1.22	1.95	.67	4.14	.86	4.40	.81
313	.83	.23	.40	.10	1.10	.08	.06	.16

* Legend same as that described for Table 1.

formances on the other films, it is apparent that the snake film greatly modified the behavior of these two animals.

D. Discussion

The data from Experiment I attest to the strong visual incentives provided by a motion picture. This is best brought out by comparing the total viewing time recorded for the motion picture with that recorded for the photographs. Both depicted the same animals in the identical environment, yet total viewing time differed significantly between the two. It seems unlikely that possible differences in total illumination and/or color were responsible for the behavioral differences found between the photograph and motion picture conditions. A more adequate explanation is that it was the continuously changing scene provided by the motion picture which served to maintain the monkeys' attention for longer periods of time.

The question naturally arises as to whether the incentives afforded by the motion picture represented anything other than continuous changes in visual stimuli *per se*. The data from Experiment II, although admittedly preliminary, showed that for some animals, a view of well-articulated figures consistently maintained responsiveness at a higher level than did a view of amorphous scenes. Even the animated cartoon, a film chosen for its artificiality, received longer viewing times when projected clearly. The exception to the notion that clarity contributes to the incentive value of visual stimuli is found in the performances to the snake film. Here, unlike their previous performances, two monkeys exhibited response durations that were considerably less when the film was shown in-focus as compared to out-of-focus projection.

These preliminary studies suggest that rhesus monkeys are attentive to motion pictures. But more important, they add evidence to the contention that the motion picture technique is a feasible tool to use in studying the perceptual and emotional reactions of monkeys. Specifically, response durations appear to be sensitive to changes in the incentive conditions and can, of course, be precisely measured. Repeated observations of monkeys performing in this test apparatus suggest that brief response durations are associated with fear or anxiety on the part of the monkey. These general observations furnish a lead for interpreting the monkeys' behavior in this type of testing situation. Further research, however, which employs a variety of both fear evoking and non-fear evoking situations as incentive conditions is necessary before response duration can be used as an index of the monkeys' emotional reactions to a selected array of films.

E. Summary

In Experiment I, the responsiveness of eight rhesus monkeys to visual incentives was recorded under four incentive conditions: motion picture, photographs, homogeneously illuminated screen, and darkness. Differences in performances among conditions were statistically significant with the motion picture being most effective for maintaining visual attention.

Four monkeys were shown a series of motion pictures in Experiment II which consisted of two films on monkeys, an animated cartoon, and a film on snakes. The films were shown in focus on half of the tests and grossly out of focus on the other half. With the exception of the film about snakes, three of the *S*s were more responsive when the images were projected clearly. Striking performance changes on the part of two *S*s were observed when the snake film was shown in focus.

References

1. Klüver, H. Behavior Mechanisms in Monkeys. Chicago: Univ. Chicago Press, 1933.
2. Tukey, J. W. Comparing individual means in the analysis of variance. *Biometrika*, 1949, **5**, 99-114.

Department of Psychology
University of Chicago
Chicago 37, Illinois

The Journal of Genetic Psychology, 1961, 98, 247-253.

DIFFERENTIAL STUDY OF RECIDIVISM AMONG NEGRO AND WHITE BOYS*

Department of Psychology, Southern University

COMRADGE L. HENTON AND CHARLES WASHINGTON

A. INTRODUCTION

This study is the outgrowth of a class project by a student in sociology. The initial research was designed to gather information on recidivism among Negro boys who were, at the time the reseach was done, serving time in the Louisiana Industrial School for Negro boys and especially on those who were then three-time repeaters. Clinical case histories were investigated to determine, "What it was that caused these boys to repeat their unsocialized behavior."

After these data were submitted, the writers felt that it might be significant to investigate recidivism among white boys to determine whether the nature of their offenses were similar to that for the Negroes. In the first place, very few research studies have lent themselves specifically to recidivism among adolescents.

The present study is an attempt to determine differences between Negro and white boy repeaters in (*a*) nature of commitment, (*b*) socio-economic factors, (*c*) emotional factors, and (*d*) the incorrigibility of their behavior. Case histories of white boys, who had been admitted to one of the white training schools for delinquent boys in the State of Louisiana for three or four times, were studied and compared with case histories of Negro boys to determine whether the nature and cause of their unsocialized behavior was significant.

B. METHOD

Clinical case histories of eight Negro and eight white delinquents who were at the time serving time in two of the Louisiana State Training Schools for boys, were studied and interviews were held with counselors at the institutions to secure additional information bearing on problems involved in this study.

The writers felt that the best possible control would be to limit the investigation to Negro and white boys who were presently serving time in two of the training schools for delinquent boys in the State of Louisiana,

* Received in the Editorial Office on July 22, 1959.

also, those delinquent boys who were institutionalized for three or more times. Three-time repeaters were used as an index to determine whether the behavior of the eight Negro and white delinquent boys were incorrigible.

All of the Negro recidivists were in the institution for the third time. Three of the white recidivists were in the institution for the fourth time and five were three-time repeaters.

C. Ages

The ages of recidivists in Table 1, ranged from 12 to 18 years. One white boy was 12 years of age and two of the Negro boys were 13 years of age. Fifty per cent of the white boys and 37.5 per cent of the Negro boys

TABLE 1
Ages of Negro and White Recidivists

Age	White	Percentage	Negro	Percentage
12	1	12.5	0	0
13	0	0	2	25.0
14	1	12.5	0	0
15	1	12.5	0	0
16	0	0	1	12.5
17	4	50.0	3	37.5
18	1	12.5	2	25.0
Total	8	100.0	8	100.0

were 17 years of age. The largest age range for both groups in this study was 17 and 18 years. Data from Axelard's (1) study show that the "ages of Negro and white institutionalized delinquents ranged from 10 through 16." The delinquents in Axelard's study came from urban as well as rural areas.

D. Socio-Economic Status

The average number of children in the eight white families was 1.25. The average number of children in the eight Negro families was 3.12. Further analysis of Axelard's data indicate that "Negro children came from families which were smaller than those of the white children. . . . The median number of children in the Negro family was a little more than 3; for the white family, almost 6." In the present study, the average number of children in the Negro family was 4.37; for the white family, 3.75. Fifty per cent of the white boys and 62.5 per cent of the Negro boys came from low socio-economic environments. Twenty-five per cent of the white and 12.5 per cent of the Negro boys came from lower-middle class homes. One Negro boy came from the middle class group and one white boy came from

the upper-middle class group. Reiss (3) suggested that "delinquents who reach the court came in large proportion from the lower economic status group in our society." Indications are that the majority of the recidivists in this study came from the lower economic and status group in our society.

E. Marital Status of Parents

Data for marital status of parents show that 12.5 per cent of the Negro and white parents were divorced; 12.5 per cent of the white and 25.0 per cent of the Negro parents were separated; and 12.5 per cent of the white fathers and 37.5 per cent of the Negro fathers were deceased. Also, 25.0 per cent of the white fathers were in mental institutions and 25.0 per cent of the white and Negro parents were married and living together.

Items of significance manifested themselves horizontally. Due to the small sample, the items were not significant vertically because the groups equated numerically. One Negro boy was born out of wedlock. There were no similar cases among white boys.

F. Occupational Status of the Fathers

Occupational status of the fathers could not be adequately treated in this study. Of the 16 cases, only two of the white and Negro parents were married and living together. One white father and three Negro fathers were deceased. Two of the white fathers were confined to mental institutions. The remaining number of fathers were either non-supporters or family deserters, and in many cases, their occupations were not known.

G. Religion

Religious preferences among white boys were: Church of God, 2; Catholic, 1; Pentecostal, 1; Methodist, 1; and two listed none. Religious preferences for Negro boys were not as stratified as those of the white boys. Instead, there were: Baptist, 4; Holiness, 2; and two claimed no preferences.

H. Disposition of Parents in the Home

The status of the child in the home is reflected in the disposition of the parents. Data from clinical case histories indicates that "two of the white boys were unwanted and one was a stepchild." Data from clinical case histories of Negro boys show that "One was illegitimate, one was unwanted, and two were a stepchild."

The disposition of the parents in the home is reflected to a large degree in the child's overt behavior. Data from clinical case histories show that of the white parents;

> One father drank wine and fought the mother. This created a negative attitude in the child toward drinking. One of the mothers was an alcoholic and practiced open prostitution. The mother was seldom able to attend to the child's needs and the father was in no position to substitute for the mother's behavior because he was a patient in a mental hospital until he died. One father was hostile toward the child because he was obsessed with an idea that the child was not his. The child was born while he was overseas during World War II. The mother often whipped the child to enforce toilet training during early infancy. One father did not assume his responsibilities in the home and the children were often without food and proper clothing. One white mother had married and divorced three times.

The disposition of the parents in the Negro home was somewhat different from that of the white parents. Before one Negro father died;

> he had a record of law violation, drinking and fighting, and had served time in the state penitentiary. The subject in this case was incorrigible at home and did not seem to be concerned about what would happen to him. One mother was mentally deficient and the father was a victim of a severe case of syphilis of which he was never cured before he died. The mother, being mentally deficient, was incapable of adequately supervising the child.

In the case of three parents,

> there was a social distance between them and the child. Efforts in two cases were made, on the child's part, to bridge this gap but the parents were indifferent. One Negro mother lived with a common-law husband and often the child was without food and proper clothing.

Indications are that the adverse disposition of Negro and white parents in the home contributed to delinquent behavior.

The behavior of these parents did not differ greatly from that of the parents in Reiss's study (3) in which he stated that "the primary group controls which characterized the families of delinquents with defective super-ego controls show that they often come from families characterized by separation, desertion, or divorce, as well as death of a parent. . . . Parental interaction is frequently marked by open conflict or hostility . . . and the parents less often represent conventional moral ideals and adequate techniques of control."

I. Intellectual Factors

Test results among the white boys showed that one had an IQ of 105, four were borderline, and three were dull normal. Test results for Negro boys did not differ greatly from those of the white boys. Three of these boys were dull normal, two borderline, and three were average. "Cecil

W. Mann and Helen Power Mann found among 428 child recidivists lower IQs (Average IQ 84) arraigned in the Los Angeles Juvenile Court. The Glucks found recidivists to deviate in the same direction." The average IQ of white boys in the present study is 85; for Negro boys 88. Data from one of the Negro boys' case history showed that he was a "B" average student in school but could not make adequate adjustments. Psychological tests used to determine the IQs of these recidivists were: *Wechsler Intelligence Scale for Children and the SRA Non Verbal Scale.*

J. Offenses

The nature of the offenses committed by the Negro and white boys is presented in Table 2. Two of the white boys were serving time for theft, one for property damage, one for malicious mischief, one for burglary, two for burglary and theft, and one for ungovernable behavior. Three of the Negro recidivists were institutionalized for theft, one for burglary, one for burglary and theft, two were ungovernable, and one was institutionalized for theft and intoxication.

TABLE 2
THE NATURE OF OFFENSES COMMITTED BY NEGRO AND WHITE BOYS

Offense	White		Negro	
	No.	%	No.	%
Theft	2	25.0	3	27.5
Property damage	1	12.5	0	0
Malicious mischief	1	12.5	0	0
Burglary	1	12.5	1	12.5
Burglary and theft	2	25.0	1	12.5
Ungovernable	1	12.5	2	25.0
Theft and intoxication	0	0	1	12.5
Totals	8	100.0	8	100.0

The offenses of the white boys differ from those of the Negro boys in property damage and malicious mischief. The offenses for the Negro boys that differ from those of the white boys were theft and intoxication. In Axelard's study, "23 per cent of the white delinquents had three offenses against 17 per cent of the Negro delinquents, and 20 per cent of the white delinquents had four or more offenses as against 8 per cent of the Negroes. Of the major offenses, white children were committed for more serious offenses: burglary, 48 per cent white, 29 per cent Negro; larceny, 49 per cent white, 24 per cent Negro. . . . White delinquents were more prone to be committed for truancy than the Negro delinquents" (1).

K. Main Reasons for Recidivism

Clinical interpretation of data as revealed in the case histories show that the main reasons for recidivism among the white delinquents were: broken homes, 2; low mental abilities, 1; lack of mother's interest, 1; absence of adequate home life, 2; father rejection, 1; and lack of proper food and clothing, 1.

The main reasons for recidivism among Negro delinquents were: lack of proper supervision, 2; broken home, 1; social distance, 2; low mental abilities, 2; and low mental ability of mother, 1.

L. Emotional Factors

Further analysis of clinical data revealed that these delinquent boys experienced severe emotional tones. The disposition of the parents in the home and their attitude toward the child among white recidivists were manifested in infantile confusion, extreme sensitivity, restlessness and anti-social tendencies, and sad-feeling-tones. The emotionalized tones of the Negro recidivists manifested themselves in severe deprivation given to extreme anger over minor incidents, schizophrenic personality, and deep-seated loneliness.

M. Summary

Due to the small number of cases included the conclusions from this study are inconclusive. However, the major findings are summarized. The subjects were chosen at random and three-time repeaters were used as an index to determine whether the behavior of these recidivists was incorrigible. Interviews with counselors in the institutions revealed that the inability of these boys to correct their behavior lies largely in their insatiable desire not to conform, but was due also largely to the stresses and strains of the environment to induce a felt need for them to reform their unsocialized behavior. Indications from counselors are that a number of these boys returned to the institution because they could not adjust to the low standards of living in the home, and some stated that they were ostracized in their school and community. These ego-involvements are threats to any organism and serve as psychological blocks to adjustment.

Age level differed slightly. One white delinquent was 12 years of age, two of the Negro delinquents were 13 years old, and the largest age range for both groups was 17 and 18 years. There were more children per family among the Negro group than among the white group.

The socio-economic conditions of the two groups differed slightly. Fifty per cent of the white delinquents and 62.5 per cent of the Negro delinquents

came from low socio-economic environments. Evidence from counselors in the institutions indicates that socio-economic conditions are contributing factors to recidivism. Divorce, separations, and defective mental abilities may have greater weight in determining action patterns of recidivism in the home.

The disposition of parents in the home in many cases serves as threats to the homeostasis of the child. Parental neglect, unsocialized behavior of the parents in the child's presence (fighting, drinking, open prostitution), and venereal diseases, which can contribute to congenital defects, may give rise to personality differences.

The main reasons for recidivism in this study do not differ significantly. Negroes differ from whites in social distance. The emotional factors of the two groups differ in degrees, although all of the delinquents were subjected to emotionalized tones within the family structure.

The attitudes of the parents and their predispositions toward morals and values within the family constellation may serve as a matrix between an adjusted personality and delinquent behavior.[1]

References

1. Axelard, S. Negro and white male institutionalized delinquents. *Amer. J. Sociol.*, 1952, **57**, 569-574.
2. Gluck, S., & Gluck, E. University Juvenile Delinquency. New York: Commonwealth Fund, 1950.
3. Reiss, A. J., Jr. Social correlates of psychological types of delinquency. *Amer. Sociol. Rev.*, 1952, **17**, 710-718.
4. Vedder, C. B. The Juvenile Offender: Prospective and Readings. Garden City, N.Y.: Doubleday, 1954.
5. Wattenberg, W. W. Juvenile repeaters from two view points. *J. Sociol.*, 1953, **18**, 631-635.
6. ———. Differences between girl and boy repeaters. *J. Educ. Psychol.*, 1956, **47**, 137-146.

Department of Psychology
Southern University
Baton Rouge, Louisiana

[1] The authors wish to express appreciation of the assistance given by the personnel at the Louisiana Training School for boys. The writers would like to thank the following persons for their critical reading of the manuscript: Dr. E. C. Harrison, Dr. Blyden Jackson, and Dr. Lionel H. Newsome, Southern University.

The Journal of Genetic Psychology, 1961, 98, 255-264.

THE EFFECT OF SOCIO-ECONOMIC AND EMOTIONAL FACTORS ON THE ONSET OF MENARCHE AMONG NEGRO AND WHITE GIRLS*

Department of Psychology, Southern University

COMRADGE L. HENTON

A. PROBLEM

In a previous study (5) the writer undertook to determine whether or not the onset of menarche among Negro girls differed significantly from the onset of menarche of white girls.

Subjects in the study were 133 white girls and 801 Negro girls whose ages ranged from 11 through 18 years. The two groups were found to produce approximately equal results in (*a*) statements to items "Have you begun to menstruate?" and "At what age?" according to ages of all grades; (*b*) difference of mean age and standard deviation within groups; (*c*) difference of mean age between groups; (*d*) difference between total mean age and standard deviation between groups. Data based on the instrument used (schedule) revealed no significant differences.

The present study is concerned with the effect of socio-economic and emotional factors on the onset of menarche among Negro and white girls.

Contention is born out in previous research by Engelmann (2), Gould and Gould (3), Michelson (6), and Garrison (4) that although the onset of menarche is a normal stage of physiological development in the female organism, it does not always work in harmony with the adolescent's total developmental pattern. The variables which exist between organisms are great and the degree to which the adolescent's organism will be able to make adjustments will depend upon its predispositions toward this stage of his maturity. These predispositions may be reflected in various emotionalized states.

Answers to certain items in the schedule (5) led the writer to believe that prior to, or accompanying the onset of menarche, a number of these children approached this phase of their physiological maturity with a feeling of fear, guilt, or disgust.

On the basis of these and similar responses, the following questions may be raised: (*a*) Are the emotions which accompany this phase of physiological

* Received in the Editorial Office on July 22, 1959.

development comparable in both Negro and white girls? (*b*) How does the onset of menarche of Negro and white girls from similar socio-economic conditions compare? (*c*) To what extent do Negro and white mothers counsel with their daughters prior to the onset of their menarche?

B. Method

This study is an outgrowth of data collected for a previous article (5). In addition to the cross-sectional method, the percentages and chi-square were computed to determine whether the difference between the percentages in socio-economic factors, emotional factors, and living conditions is significant in the onset of menarche for Negro and white girls.

C. Socio-Economic Factors—Negro and White

1. *Occupational Status of Negro and White Mothers*

Studies by Mills (7) and Michelson (6) show that living conditions are some of the factors responsible for differences in the age at menarche for different racial groups. Further analysis of Michelson's data suggest that age of maturity is linked with socio-economic status and shows similar values for whites of different origin as well as for Negroes belonging to similar income groups.

According to answers in the schedule, there were 127 white mothers and 693 Negro mothers living. The occupations of mothers, shown in Table 1, reveal that 12.50 per cent of the white mothers and 13.00 per cent of the Negro mothers were engaged in professional and managerial work. Negro mothers outnumbered white mothers in teaching, school supervisors, medical supervisors, and supervisors of social agencies in the areas of YWCA and Girl Scouts. In clerical and kindred work, 12.50 per cent of the white mothers and 16.00 per cent of the Negro mothers were employed.

In domestic service, 6.25 per cent of the white mothers were listed to 66.74 per cent of the Negro mothers which shows a significant difference in the number of whites and Negroes in this occupational group. Sixty-three per cent of the white mothers were listed for "Personal Service" and none for "Agriculture" whereas 7.16 per cent of the Negro mothers were engaged in personal services and 1.6 per cent in agriculture, including dairying. In personal services, there were more Negro mothers employed as practical nurses and beauticians.

Thirty-seven per cent of the white mothers and 49.0 per cent of the Negro mothers were engaged in manufacturing and retailing. The majority of

both groups were factory workers and self-employed seamstresses. Of these numbers, four Negro mothers were self-employed seamstresses.

Inferences may be drawn on the basis of the above data that the occupational status of the two groups is somewhat similar. The standard error of difference between two percentages is 5.097 which is not significant for 8 degrees of freedom at the .05 level of confidence. The greatest area of difference lies within domestic services in which Negro mothers outnumber white mothers 57 to 1.

TABLE 1
OCCUPATIONS OF WHITE AND NEGRO MOTHERS

	White			Negro			
	No.	%	χ^2	No.	%	χ^2	σ
Professional and managerial	8	12.50	.037	49	13.00	.048	5.06
Semi-professional	1	1.56	.036	6	1.59	.047	5.92
Managerial and official	1	1.56	.036	1	.26	.044	5.68
Clerical and kindred	8	12.50	.037	27	7.16	.087	3.30
Domestic service	4	6.25	.076	229	60.74	.032	8.25
Personal service	10	15.62	.036	27	7.16	.087	9.41
Agricultural	0	0	.010	4	1.06	.097	3.36
Manufacturing and retail	22	34.37	.032	32	8.49	.063	6.17
Public work	10	15.62	.036	2	.53	.035	4.02
Total	64	99.98	.326	377	99.99	.540	5.097*

* Not significant for .05 degrees of freedom.

2. *Occupational Status of Negro and White Fathers*

From Table 2, 13.33 per cent of the white fathers were gainfully employed in professional and managerial occupations to 6.37 per cent of the Negro fathers. White fathers outnumbered Negro fathers in medical doctors, lawyers, and accountants. On the contrary, there were more school teachers, principals, college professors, and ministers among Negro fathers.

Also from Table 2, it may be noted that the same number of Negro and

white fathers are listed for semi-professional and managerial and official occupations with 2.22 per cent of the white males and 98.0 per cent of the Negro males engaged in managerial and official occupations. Most of the Negro men listed under managerial and official occupations were connected

TABLE 2
OCCUPATIONS OF WHITE AND NEGRO FATHERS

	White			Negro			
	No.	%	χ^2	No.	%	χ^2	σ
Professional and managerial	12	13.33	.098	26	6.37	.094	3.39
Semi-professional	2	2.22	.094	4	.98	.007	9.43
Managerial and official	8	8.89	.037	8	1.96	.044	5.75
Clerical and kindred	11	12.22	.092	26	6.37	.094	3.26
Domestic service	0	0	.001	7	1.71	.045	4.50
Personal service	4	4.44	.080	26	6.37	.094	3.90
Protective service	18	20.00	.094	87	21.33	.064	3.69
Agriculture, fishing, forestry, etc.	14	15.55	.097	20	4.90	.035	3.36
Manufacturing and retailed activity	5	5.55	.060	78	16.76	.033	6.85
Construction	11	12.22	.099	43	10.54	.047	3.56
Transportation	5	5.55	.060	83	20.34	.094	3.53
Total	90	99.97	.722	408	97.53	.651	5.072*

* Not significant for .05 degrees of freedom.

with insurance companies, funeral homes, and educational institutions while the white males were employed in industry, insurance, and private businesses. For domestic services, there were no white males but 1.71 per cent Negro males. These men were employed as cooks or yardmen. Personal service included 4.44 per cent of the white men and 6.37 per cent of the Negro men. Three of the white fathers and two of the Negro fathers were barbers. Nine of the Negro fathers were waiters, two were bartenders, and the

remaining 13 were either doormen, hospital attendants, or bellmen. Twenty per cent of the white fathers and 20.33 per cent of the Negro fathers were employed in protective services. Of the 18 white fathers, 13 were farmers, one was an assistant chief of police, one was a deputy sheriff, one was a policeman, one was a fireman, and one was a member of the Coast Guard. Of the 87 Negro fathers, there were 22 farmers, one landscaper, 7 firemen (industrial), 18 janitors, 19 porters, and 6 night watchmen. The remaining 14 were employed in some branch of the army and as pullman porters. In construction work 12.22 per cent of the Negro fathers and 10.54 per cent of the white fathers were employed. These occupations included carpenters, cement and concrete finishers, painters, plasterers, and plumbers. There were more Negro fathers employed in manufacturing and retailing and production of fabrics and products than were white fathers. The majority of the Negro fathers were butchers, 5; processors of food, 7; tailors, 9; and factory workers, 24. Of the white fathers, one was a miller, one a cotton mill worker, one a spinner in a cotton mill, one a sawmill worker, and one a textile worker.

In transportation 5.55 per cent of the white fathers and 20.34 per cent of the Negro fathers were employed. Of these numbers, three of the white fathers were chauffeurs and two were brakemen. For the Negro fathers, 43 were chauffeurs, 39 were brakemen and one was a locomotive engineer. Two of the white fathers were unemployed and one was retired. Two of the Negro fathers were unemployed and six were retired.

It may be well to note that although Negro males were gainfully employed in similar occupations as white males, with the exceptions of doctors, ministers, government, and construction workers, salaries of Negroes are not commensurate with those of whites. Although the statistical difference is not significant at the .05 level of confidence and it is evident that there is less than one chance in 100 that the actual difference between the two means might have arisen due to chance, data from items in the schedule reveal that differences in occupational status are significant, especially for Negro men due to restricted employment opportunities. Hence, these two groups differ in the main, not in occupational classifications, but in income.

D. Religious Affiliations of Negro and White Parents

Religious affiliations may or may not be associated with socio-economic status. According to answers to items in the schedule, 59.05 per cent of the white mothers and 54.91 per cent of the white fathers were associated with the Baptist church, with 60.42 per cent of the parents belonging to the same religion. Among the Negro group, 73.45 per cent of the mothers

and 67.67 per cent of the fathers were members of the Baptist church, with 78.52 per cent of the parents of the same religion. Over 50 per cent of both groups were members of the Baptist church.

The second largest number of religious affiliates were members of the Methodist church of which 19.68 per cent were white mothers, and 22.95 per cent were white fathers with 22.92 per cent of both parents belonging to the same church. Of the Negro parents, 17.89 per cent were mothers and 16.56 per cent of the fathers were Methodists, with 14.53 per cent of each parent of the same denomination.

The third ranking denomination among white parents was Presbyterian of which 7.87 per cent of the mothers and 5.73 per cent of the fathers were represented, with 6.25 per cent of both parents of the same faith. The third ranking denomination among Negro parents was Catholic of which 2.31 per cent of the mothers and 2.21 per cent of the fathers were members, with 1.52 per cent of both parents represented.

In descending order among white parents were: Episcopalian, Catholic, Christian, Holiness, and Alliance. Of these denominations, Alliance differed from those denominations represented by Negroes. In descending order among Negro parents were: Christian, Church of Christ, Lutheran, Seventh Day Adventist, Holiness, Jehovah's Witness, Presbyterian, Episcopalian, Church of God, and Sanctified. Of these denominations, Lutheran, Jehovah's Witness, Church of God, Church of Christ, Seventh Day Adventist, and Sanctified differed from those of white parents.

E. Living Conditions

Previous studies by Mills (7) and Michelson (6) reveal that living conditions are closely associated with the onset of menarche among girls. In examining the living conditions of both groups, all of the white girls or 100 per cent stated that their homes were equipped with electric lights as compared with 88.76 per cent of the Negro girls. Eighty-one per cent of the white girls had bathrooms, 72.94 per cent had bath tubs. For the Negro girls, 63.5 per cent had bathrooms, 51.44 per cent had face bowls, 64.54 per cent had stools, and 52.6 per cent had bath tubs.

From the above data, living conditions of the homes of the Negro girls were inferior to those of the white girls. This may or may not be reflected in the health conditions of these girls for 33.83 per cent of the white girls and 35.83 per cent of the Negro girls suffered with eye strain, although all homes of the white girls were electrically lighted.

Sixty-four per cent of the white parents owned their homes and 28.57

TABLE 3
RELIGIOUS AFFILIATIONS

Religious	White mothers No.	%	χ^2	White fathers No.	%	χ^2	Same No.	%	χ^2	Negro mothers No.	%	χ^2	Negro fathers No.	%	χ^2	Same No.	%	χ^2	Female W-N σ	Male W-N σ	Same σ
Baptist	75	59.05	.014	67	54.91	.054	58	60.42	.050	509	73.45	.062	425	67.72	.072	362	78.52	.55	6.36	8.49	8.47
Methodist	25	19.68	.035	28	22.95	.089	22	22.92	.033	124	17.89	.049	104	16.56	.036	67	14.53	.042	5.03	3.60	3.20
Catholic	1	.79	.36	2	1.64	.083	1	1.04	.087	16	2.31	.033	17	2.21	.032	7	1.52	.092	4.91	9.99	3.23
Lutheran	0	0	.001	0	0	.001	0	0	.001	5	.72	.063	5	.79	.031	3	.62	.089	6.38	3.10	9.14
Episcopalian	8	6.30	.054	6	4.91	.064	6	6.25	.062	1	.14	.012	1	.16	.036	1	.22	.031	5.53	7.34	6.93
Presbyterian	10	7.87	.031	7	5.73	.059	6	6.25	.062	2	.29	.032	0	0	.001	2	.43	.035	5.45	5.90	7.12
Christian	1	.79	.049	0	0	.001	12	1.73	.034	11	1.75	.036	8	1.73	.032	8	1.73	.032	5.96	3.74	3.35
Jehovah's Witness	0	0	.001	0	0	.001	0	0	.001	2	.29	.032	2	.32	.033	2	.43	.035	3.30	3.45	3.52
Church of Christ	0	0	.001	0	0	.001	0	0	.001	8	1.15	.036	13	2.07	.035	5	1.08	.044	3.74	3.64	4.56
Seventh Day Adventist	0	0	.001	0	0	.001	0	0	.001	4	.58	.025	1	.16	.037	1	.22	.031	2.69	3.83	3.26
Church of God	0	0	.001	0	0	.001	0	0	.001	1	.14	.035	0	0	.001	0	0	.001	3.52	0.01	0.01
Holiness	1	.79	.031	3	2.44	.076	3	3.12	.085	3	.43	.028	3	.48	.029	3	.65	.048	3.18	8.13	9.76
Sanctified	0	0	.001	0	0	.001	0	0	.001	1	.14	.035	0	0	.001	0	0	.001	3.52	0.01	0.01
Alliance	0	0	.001	1	.82	.038	0	0	.001	0	0	.001	0	0	.001	0	0	.001	0.01	3.80	0.01
No answer	4	3.93	.083	3	2.44	.076	0	0	.001	5	.72	.063	42	6.69	.073	0	0	.001	3.29	3.33	0.01
None	2	1.57	.080	5	4.10	.069	0	0	.001	0	0	.001	4	.64	.024	0	0	.001	8.10	7.30	0.01
Totals	127	99.67	.426	122	99.94	.606	96	100.0	.399	693	99.98	.591	628	100.0	.460	461	99.95	.539	7.160	7.787	6.259

per cent were renters. Contrastingly, only 46.82 per cent of the Negro parents were home owners and 41.57 per cent were renters.

Living conditions in the homes of the Negro group were markedly different from that of the whites. There were no cases of overcrowded living conditions among the white group. This was not true with the Negro group. The number of persons living in two rooms ranged from six to 10; in three rooms, six to 12; in four rooms, eight to 13; in five rooms, 10 to 12; and in six rooms, 10 to 18. Inferences may be drawn on the basis of those data that living conditions among Negro girls in this study are inferior to those of the white group.

F. Emotional Factors

Questions were designed in the schedule to determine the emotional effect of the onset of menarche in Negro and white girls. Answers to the items in the schedule, "How did it (the onset of menarche) affect you?" led the writer to believe that some of these girls approached this phase of their maturity with a feeling of fear, guilt, and disgust.

Among the white girls, 13.60 per cent felt ashamed, 5.87 per cent felt happy, and 14.10 per cent stated that this phase of their maturity had no effect on them. In addition to the above stresses, a number of these girls expressed mixed emotions. Some felt happy and unhappy, worried and happy, and ashamed and happy.

Answers to the question "If you could change your physical features, what would you change?" elicited the following responses: 37.0 per cent of the Negro girls would change their menstruation and 25.0 wanted to start menstruating. None of the white girls expressed these feelings. Although a small number of these girls approached their maturity with mixed emotions, 40.60 per cent of the white girls and 14.10 per cent of the Negro girls manifested no exaggerated emotions.

Cole states that "evidence has been established that girls may receive a considerable emotional shock from their menstruation, whether or not they have been warned of its arrival, since there is something understandably terrifying in a hemorrhage that cannot be stopped. Bleeding is so associated with unpleasantness that many girls can never dissociate this emotional tone from their menstrual period" (1, p. 78).

Seventy-six per cent of the white girls and 62.79 per cent of the Negro girls were prepared for this phase of their maturity by their mothers. Two per cent of the Negro girls were prepared by their family doctor. Two per cent of the white girls and 62.0 of the Negro girls were prepared

by the nurse. However, 27.82 per cent of the Negro girls were prepared by girlfriends, cousins, or teachers. Only one of the white girls stated that she was prepared by the teacher and none by sister, girlfriends, or cousin. Indications are that some Negro mothers do not counsel with their daughters prior to the onset of their menses. This may be explained on the basis that some of the Negro mothers suffer with a feeling of guilt and find it very

TABLE 4
EMOTIONAL FACTORS OF NEGRO AND WHITE GIRLS

How did it affect you?	White			Negro			
	No.	%	χ^2	No.	%	χ^2	σ
Upset	17	16.35	.037	122	20.68	.037	.042
Unhappy	3	2.88	.083	80	13.56	.038	.091
Unclean	3	2.88	.083	60	10.17	.039	.091
Worried	12	11.54	.092	59	10.00	.039	.099
Ashamed	2	1.92	.088	109	18.30	.037	.094
Happy	13	12.50	.092	47	7.97	.059	.034
No effect	54	51.92	.066	113	19.15	.037	.084
Total	104	99.99	.541	590	99.83	.286	.534*

* Not significant at the .05 level of confidence.

TABLE 5
MIXED EMOTIONS OF NEGRO AND WHITE GIRLS

How did it affect you?	White			Negro			
	No.	%	χ^2	No.	%	χ^2	σ
Unclean and worried	1	8.33	.037	4	7.69	.067	.076
Unhappy and unclean	1	8.33	.037	7	13.46	.031	.048
Ashamed and happy	1	8.33	.037	5	9.61	.087	.094
Worried and ashamed	1	8.33	.037	6	11.54	.031	0.48
Upset and unhappy	1	8.33	.037	14	26.92	.037	.042
Upset and unclean	1	8.33	.037	8	15.38	.056	.067
Unhappy and happy	2	16.67	.083	0	0	.001	.092
Upset and sick	1	8.33	.037	0	0	.001	.037
Scared and happy	1	8.33	.037	0	0	.001	.067
Sick and excited	2	16.67	.083	8	15.38	.056	.083
Total	12	99.98	.462	52	99.98	.368	.654*

* Not significant at the .05 level of confidence.

difficult to express themselves, while others, in addition to a feeling of guilt, do not possess enough scientific knowledge to pass on to their daughters that will minimize the stress and help them develop wholesome attitudes toward their maturity.

H. SUMMARY

The socio-economic factors of Negro and white girls are different. The occupational status of the white parents differed markedly in income and salaries from that of the Negro parents. This was a significant factor and

was reflected in the living conditions of the Negro girls. Although the critical ratio (5) in a previous study revealed no significant difference among Negro and white girls in the onset of menarche, other factors must be investigated to determine whether the inferior socio-economic conditions of Negro girls is reflected in their total physiological development, especially the onset of menses, or whether there exists a secular element.

Negro girls experienced more emotions than did white girls from the onset of their menses. White mothers seemed to have been more alert to the needs and moral attitudes of this stage of their girl's maturity. Negro girls as well as parents need more sex education and guidance to help minimize the stress in their daughter's maturity.[1]

References

1. Cole, L. Psychology of Adolescence. New York: Rinehart, 1959.
2. Englemann, G. G. Age of first menstruation on the North American continent. *N.Y. Med. J.*, **75**, No. 6, 221-270.
3. Gould, H. N., & Gould, M. R. Age of first menstruation in mothers and daughters. *J. Amer. Med. Assoc.*, **98**, 1349-1352.
4. Garrison, K. C. Psychology of Adolescence (5th Ed.). New York: Prentice-Hall, 1956.
5. Henton, C. L. A comparative study on the onset of menarche among Negro and white children. *J. of Psychol.*, **46**, 65-73.
6. Michelson, N. Studies in the physical development of Negroes: LV. Onset of puberty. *Amer. J. Phys. Anthropol.*, 1944, **2**, 151-166.
7. Mills, C. A. Geographic and time variations in the body growth and age at menarche. *Hum. Biol.*, 1937, **9**, 42-56.

Department of Psychology
Southern University
Baton Rouge, Louisiana

[1] The writer wishes to express appreciation of the assistance given by Dr. H. C. Trenholm and the students of Alabama State College, who administered schedules, and the principals of Elementary and High Schools, Montgomery, Alabama. The writer would also like to thank the following persons for their critical reading of the manuscript: Dr. L. L. Boykin, Florida A. and M. University; Dr. E. C. Harrison, Dr. E. E. Johnson, and Mrs. E. K. Kelly, Southern University.

The Journal of Genetic Psychology, 1961, 98, 265-271.

QUESTIONNAIRE ITEMS AND TYPES OF INTELLIGENCE*

Department of Psychology, University of California, Santa Barbara

WILLIAM D. ALTUS

A. INTRODUCTION

Questionnaire items have often been shown to have varying degrees of positive relationships with scores from conventional intelligence tests. During World War II, Altus (1) noted a significant relationship between an orally-administered adjustment test and Wechsler Mental Ability IQs for male soldiers in the extreme low end of the intellectual continuum. Shipley (4) likewise reported a substantial relation between adjustment test scores and General Classification Test Scores for Navy recruits. Gough (2) has pointed out that the California Ethnocentrism (E) scale is written in such a manner that a negative relation with intelligence test scores is practically assured. Gough also published an article (3) concerning what he called a "nonintellectual intelligence test," which consisted (after trimming) of 52 items of the questionnaire sort, primarily derived from the Minnesota Multiphasic Personality Inventory. This set of items showed positive *r*s ranging from .36 to .68 (median about .50) with intelligence test scores derived from secondary school, university undergraduate, and graduate school populations. Interestingly enough, the reduction in range of intelligence did not markedly attenuate the *r*s obtained among graduate students at the University of California when these *r*s are compared with those from a high-school population. For reasons not entirely clear Gough interprets his 52-item test as a sort of index of intellectual efficiency. In any event, previous studies have shown time out of mind that questionnaire items have varying positive and negative relationships with traditional intelligence test scores at all levels of the intellectual spectrum.

B. PROBLEMS AND PROCEDURES

The writer was convinced from his observations during World War II that the kind of intelligence test material determined in part the relation of questionnaire items to IQs derived from such tests. For instance, the Digit Symbol subtest is more closely related (1) to items measuring

*Received in the Editorial Office on August 5, 1959.

neurotic tendency than is any other of the Wechsler subtests, performance or verbal. It has also seemed probable that group tests with several different types of material should show differential relationships to questionnaire items, whether measuring adjustment, study habits, or any other aspect of individual differences sampled by such kind of items. The hypothesis to be tested, therefore, is that different clusters of items within the same measure of intelligence will yield varying *rs* with heterogeneous questionnaire items.

An almost universal finding in our culture is that the grades earned by females are more predictable by traditional intelligence tests than are the grades earned by males. Women also tend to work more nearly up to measured capacity than do men; for this reason, institutions such as the University of California which use secondary grades as primary criterion for admission will automatically enroll male students of a somewhat superior capacity to that of the female student. For these two reasons, differential predictability of college grades and differential entering aptitude, it was hypothesized that the same questionnaire items would show sex differences, without specifying the direction of the difference, in the magnitude of the correlation coefficients with clusters of items in the traditional kind of aptitude test.

In September, 1958, about 1,100 students who entered the University of California, Santa Barbara, for the first time were administered the Scholastic Aptitude Test (Form $ASAI_D$) of the College Entrance Examination Board. A heterogeneous 100-item questionnaire of the yes-no type was given at the same time. The kind of item found in the questionnaire will become evident later in Table 1. The verbal section (Verbal Aptitude Test or VAT) of the Scholastic Aptitude Test (SAT) was used as the criterion against which interquartile analyses of each of the 100 items in the questionnaire were tabulated for 400 of the entering students, 200 being men, 200 being women. By this method some 25 items were chosen for eventual correlation with the raw scores earned on the Scholastic Aptitude Test, VAT section. The students not employed in the interquartile analyses were used as a validating population for the new 25-item test. For 441 women in the validating group, the *r* between the 25-item test and the VAT raw scores was .493; for the 250 men, the *r* was .521; for the combined group of 691 students, the *r* was .509. Since the reliability of the 25 items is probably not too high (perhaps .70 is a fair estimate), the coefficients obtained with VAT are seen to be quite substantial. The validating *rs* are somewhat higher than those reported by Gough (3) for his 52-item test

at the Berkeley campus of the University of California, where he noted *rs* of .42 and .44.

It had been demonstrated on the validating group of entering students that the 25 items derived from the longer questionnaire had a significant and substantial relation to whatever the Verbal Aptitude Test was measuring. It now became necessary, for purposes of the present study, to item analyze the 107 items composing the Verbal Aptitude Test, using the 25 items from the questionnaire as the criterion of analysis. The population employed in this analysis was 100 men and 100 women from the original 691 students of the validating group. By the technique, two scales were derived from the VAT, each of 25 items. Scale 1 consisted of 25 items which gave indication of being somewhat more highly saturated with whatever the questionnaire items were measuring; conversely, Scale II contained 25 VAT items which seemed to be measuring *less* than the other 82 VAT items of whatever the 25 questionnaire items were measuring. It is thus apparent that Scale I, for a new validating group, should correlate to a somewhat higher degree with the 25 questionnaire items than would the items comprising Scale II.

C. Results

The VAT answer sheets for 131 men and 320 women in the original validating group who were not included in the second item analysis were now scored on the basis of the newly derived Scale I and Scale II. The *r* between the 25 items from the questionnaire and the 25 items in Scale I from the VAT was .491 for 32 women; the corresponding *r* for Scale II was .418. The *r* between the 25 questionnaire items and Scale I from the VAT was .575 for 131 men; the *r* for Scale II for the same men was .476. Though the difference between the *rs* for women is not significant and though the difference for the men does not quite reach the .05 l.c., the writer feels that the direction of the difference and the apparent sex linkage is more important in this instance than absolute significance. It will be noted for both Scale I and Scale II the *r* for the male students is higher than for the women, .575 to .491 for Scale I; .476 to .418 for Scale II.

It appears, therefore, that the two hypotheses with which the study began are vindicated in part. One can form a subscale from a traditional type of intelligence test which will correlate to a greater degree with "intellectual efficiency" items (to use Gough's terminology) than will a similar subscale drawn from the same pool of intelligence test items. It would appear tenable that sex differentials in the order of association between

"intellectual efficiency" questionnaire items and traditional items from an intelligence test may well exist, with the male showing a somewhat higher order of association. It also seems quite remarkable to the writer that he was able to obtain an r of .575 between the Scale I VAT scores for men and the 25 questionnaire items. The percentage of overlap in what the two tests measure comes to almost exactly 33, certainly a quite substantial amount when the undoubtedly rather low reliabilities of the two 25-items tests are taken into account.

Table 1 lists certain of the items from the 25-item questionnaire with the validating coefficients for each item in association with both sub-scales of the VAT, the sexes being separately listed. The brighter individuals of

TABLE 1
ESTIMATED TETRACHORIC COEFFICIENTS OF CORRELATION BETWEEN CERTAIN QUESTIONNAIRE ITEMS AND SUBSCALES I AND II FROM THE VERBAL APTITUDE TEST

Subscale I		Subscale II		Marking characteristic of brighter students	Questionnaire item
Men	Women	Men	Women		
.32	.26	.41	.14	False	I daydream very little.
.27	.10	.26	.08	False	In school life, making friends is just as important as books.
.38	.25	.17	.36	False	If one has it in him to do so, he should aim for one of the professions.
.26	.48	.32	.43	True	My relatives are nearly all in sympathy with me.
.39	.05	.28	.09	True	I sometimes keep on at a thing until others lose their patience with me.
.38	.34	.34	.28	True	I like poetry.
.22	.04	.21	.26	False	Others often talk me down even when I know that I am right.

both sexes, for instance, say false much more frequently to such an item as "I daydream very little." Whether this answer means that a fantasy life tends to go with higher intelligence or whether it means that brighter people are franker or possessed of greater self-insight is by no means clear. The writer suspects that greater insightfulness is found among the brighter, but such a presumption is but little better than a guess. The sex difference in the question relating to friends and books is of interest. It

seems reasonable that these coefficients probably represent real and significant sex *differentiae* among college students: Men probably attend college for somewhat more intellectual reasons than do women; or, put another way, for somewhat less personal reasons. The sympathy-relatives item is of interest for its relatively high validity. It may well be that the brighter student comes from a somewhat different social class where relatives are somewhat easier to get along with. It may also be that brighter people have a firmer ego and are less often cowed by relatives. The item on keeping on at a thing even though it disturbs others points to a persistence that could well be called firmness of ego. It is interesting here again to note a sex difference. The brighter male is relatively more aggressive than is the brighter female: Society condones, even rewards, the aggressive male but not so the overtly aggressive female. The item on poetry has high validity. It is one of three items among the 25 which also appear on Gough's 52-item scale; for both scales the Minnesota Multiphasic Personality Inventory is the initiating mother lode for these three items. It will also be noted that the validating *r*s are consistent for the two scales, higher for Scale I, lower for Scale II. Bright people like to read, at least more than their relatively duller brethren. Any question relating to reading, be it history, science, or newspaper editorials will show a positive linkage to tested verbal aptitude, even with the attenuation in range found at the University of California which accepts its entering freshmen from the top 10 to 15 per cent of high-school graduating seniors.

The 18 items of the 25-item questionnaire which have not been previously listed (seven appeared in Table 1) follow with the marking characteristic of the brighter student:

> 1. (True) I often finish classroom tests and turn them in before time is called. 2. (True) In my study periods it is easy for me to concentrate and get things done. 3. (True) Most of the time I am calm and collected when taking an examination. 4. (False) If I were to marry, I should prefer a mate who was fond of hearth and home, in other words liked domesticity. 5. (True) I tend to do my best work when the pressure is on. 6. (True) Some of my family have quick tempers. 7. (False) In reviewing, I tend to go over everything several times. 8. (False) My grades would be better if I didn't run around so much. 9. (False) My eyes tire easily when I read. 10. (False) Given the opportunity, I believe I would make a good leader. 11. (True) So many courses look attractive to me, I have difficulty making up a program. 12. (True) I would like to be a journalist. 13. (True) I do not always tell the truth. 14. (True) I like to read about history. 15. (True) I like to read newspaper editorials.

16. (False) I am apt to pass up something that I want to do because others feel that I am not going about it the right way. 17. (False) I'd rather be a rancher than a practising courtroom lawyer. 18. (True) I feel unable to tell anyone all about myself.

A few words should be said concerning the rationale of Scale I and Scale II of the Verbal Aptitude Test. The 25 items in Scale I, it will be remembered, were chosen so that they should, on a new, validating population, show a greater degree of relationship to whatever the 25 questionnaire items were measuring. The one place in the Verbal Aptitude Test where items on Scale I tended to cluster was where questions were asked on extremely long reading selections. Painful, conscientious reading and re-reading of the paragraphs would seem to be requisite to success in the answering of the questions thereon. The male student who says that he keeps on at a thing until others lose patience with him is probably the same person who keeps on at the long paragraphs just noted until he gets the correct answer. The only generality about any of the items on Scale II, the scale with somewhat reduced relationship to the questionnaire items, is that a set of five questions in a row is found in a section devoted to completion items, i.e., where a word or two is left out of a sentence and the student is given a set of choices from which to choose the correct word or words. The writer has a suspicion that probably these college students who do relatively quite well on Scale II are really somewhat brighter than the comparable Scale I people who doggedly read and re-read paragraphs to get the right answers. Interestingly enough, both scales correlate equally well (or equally poorly, depending upon one's point of view) with first-semester grades at Santa Barbara, the *r*, in both instance, being .33. One may well suspect that the high-scoring Scale II people have more to work with, while the analagous Scale I people work harder—the end result being the same.

D. Summary and Conclusions

It was hypothesized that a college student's answers to a set of questionnaire ("personality") items would vary in relation to aptitude test items, according to the sex of the student, and the different subsets of items to be found in the same test of verbal aptitude. Both hypotheses received limited confirmation. It was possible to derive two scales from the Verbal Aptitude Test (Form $ASAI_D$) of the Scholastic Aptitude Test which correlated differentially with 25 questionnaire items, depending upon the scale and upon the sex of the respondent.

Broadly interpreted, it would seem reasonable to interpret the findings in

this fashion: One's attitudes correlate with one's success on an aptitude test; the specific attitudes that go with one's sex are of especial significance; and, finally, the degree of correlation of attitude and aptitude appears to depend greatly upon the type of aptitude item under consideration.

REFERENCES

1. ALTUS, W. D. The adjustment of Army illiterates. *Psychol. Bull.*, 1945, **42**, 461-76.
2. GOUGH, H. C. Studies of social intolerance: I. Some psychological and sociological correlates of anti-Semitism. *J. Soc. Psychol.*, 1951, **33**, 237-246.
3. ———. A nonintellectual intelligence test. *J. Consult. Psychol.*, 1953, **17**, 242-246.
4. SHIPLEY, W. C. The personal inventory—its derivation and validation. *J. Clin. Psychol.*, 1946, **2**, 318-322.

Department of Psychology
University of California
Santa Barbara, California

The Journal of Genetic Psychology, 1961, 98, 273-277.

PRELIMINARY OBSERVATIONS ON PLAY BEHAVIOR IN PUPPIES*

Department of Psychology, University of Georgia

WILLIAM T. JAMES[1]

A. THE PROBLEM

Play behavior has been observed many times in the course of various studies on the behavior of puppies during the past few years. Since there is an increased interest in behavior not motivated by a specific physiological need, a number of attempts have been made to record play activity without any degree of success.

Puppies are usually reared together and become accustomed to a particular living area. If one member is removed from the group, this animal is so disturbed it will not play. Its main interest seems to be in getting back to its usual quarters. In one case a number of puppies were removed to another room for observation. These animals did engage in play, but the behavior could not be recorded since it was so variable and rapid. In another test two animals were placed in an observation room with a one-way screen used by students while observing the administration of tests to children. Two objects were placed in the room as stimuli. In this situation, the puppies engaged mainly in excited yelping and scratching on the door. From these observations, it seemed evident puppies would play only in their usual environment and a limited number of animals would have to be studied in order to observe and describe the behavior.

In recent studies, Welker (2, 3, 4) has described a successful quantitative analysis of play and manipulative behavior in the chimpanzee. In these studies two or more objects were presented for a number of 6-minute sessions, and recordings made every five seconds of the behavior, whether manipulative (mouthing, biting, smelling, scratching, slapping, rubbing, grasping, etc.) or orienting. Interest was in the preference for the objects presented and changes toward them during repeated sessions. It was observed that some objects elicited more manipulative behavior than others; satiation tended to occur on repeated presentations; changes in objects elicited more active interest, and there were differences in play between young and older

* Received in the Editorial Office on August 7, 1959.
[1] This investigation was supported, in part, by funds from the Graduate School of the University of Georgia.

animals. A modification of this procedure has been used on a preliminary study in puppies at the University of Georgia, and this method had given the first quantitative results indicative of play in these animals.

B. Subjects

Two litters of six puppies each were used in the experiments. Six animals were hybrid Cocker-Spaniel by Beagle-Terrier; and six others were pure Beagle puppies. The animals were born and reared in the Laboratory of the Psychology Department in an environment relatively free of objects which could be manipulated. At the beginning of the tests, the Cocker-Beagle-Terrier puppies were 2½ months of age, while the Beagles were three months of age.

C. Apparatus

For the present study pairs of objects were placed in the kennel with the dogs. The stimuli differed in shape and texture, and one pair differed in its sound quality, but no previous theory was used in selecting them. The stimulus objects are shown in Figure 1. The first two objects consisted of two balls 7½ cms. in diameter. One ball had six flanges 3.5 by 4 cms. made of rubber. The second pair consisted of two boxes 12 by 8 by 6.5 cms. made of ¼-inch plywood. One box contained a clock works which made a ticking sound, while the other had a short wire projecting from the side. Objects No. 3 consisted of two blocks, one made of wood, and one of soft rubber. Both blocks were 14 by 5 by 1 cms. in area. The soft block was covered by a cloth to keep it from breaking apart. Object 4 was composed of a small ten-cent-store doll 14 cms. long which gave a squeaking sound when pressed. The other was a wooden rectangular block of wood of approximately the same length and width. Object 5 was composed of two "bones," one made of rubber from the ten-cent-store, and the second made of wood. Both bones were aproximately 11½ by 1.5 cms. Articles 6 were a piece of circular cloth 32 cms. in diameter with ends sewed together, and this was matched with a piece of cardboard 17 by 5 cms. in area.

D. Procedure

Since preliminary observations indicated puppies would not play in a strange environment, for the present study the animals were left in their own kennel during the tests. It has also been observed that removal from the group, if the animals had lived together, was also disturbing, and for this reason two animals were together for each observation. During the tests,

the various pairs of objects were placed in the kennel with two dogs. The same dogs were always tested together each time. The experimenter remained behind a screen to observe. Switches were used to activate two pens on a slow moving kymograph in an adjoining room. Each pen represented one of the objects, and each time that object was manipulated in any way, the key for that object was pressed by the experimenter and held

FIGURE 1
THIS FIGURE SHOWS THE PAIRS OF STIMULUS OBJECTS USED IN THE ANALYSIS OF PLAY AND MANIPULATIVE BEHAVIOR IN PUPPIES

down as long as the puppy played with the object. Since a time marker was also on the record, the total amount of time each object was manipulated during the test could be measured. If both objects were manipulated, one by each dog, or if one dog shifted from one to the other, all records were indicated. The interest was not in the particular puppy on these tests, but in the total time each object was manipulated. In most cases each pair of objects was presented for a 5-minute session each day, one pair after another until each pair had been tested for the day. The objects

were presented in the following order on each test period: 1-2-3-4-5-6. This procedure was repeated until each object had been tested five times.

E. Results

The tests indicated that all objects elicited manipulative behavior, but some were definitely more attractive than others. Those which received attention better than chance expectancy are shown in Table 1, in which the

TABLE 1
Probabilities of Differences in Objects Used to Test Preference

Object pair	No. tests	Object chosen	P
1	30	Flange Ball	.004
2	30	No Choice	n.s.
3	29	Soft Block	.10
4	29	No Choice	n.s.
5	22	No Choice	n.s.
6	23	Cloth	.001

probabilities are indicated by the Sign Test, (1). As a rule one dog would hold the more attractive object and protect it from the other. In every case, this was the dominant dog of the two.

Objects which elicited the most manipulative behavior were mainly those which could be held in the mouth, shaken, bitten, and carried around. The ball with flanges in Pair 1; the soft block in Pair 3; and the cloth of Pair 6 received the greatest amount of attention. In Pair 6 there were many observations of social play. In this behavior each animal would hold one end of the cloth and pull, or one animal would run around the kennel with the cloth while the other chased trying to grab it.

There were also differences in choice among the other pairs of objects, but the P. was not as great. In Pair 2, the box with the short wire attached received more attention than the box with the ticking sound. In this case, the wire was held by the teeth while the box would be pulled along, or the feet would hold the box and the animal would pull on the wire. In Pair 4, the doll received the greatest attention. The softness of the doll, plus the ease with which it could be held in the mouth and transported, seemed to be the significant factor. In Pair 5, the rubber bone was definitely more attractive than the hard bone.

In case of the pairs in which one object was not definitely more attractive than the other, there was a great deal of parallel play, each animal manipulating one object, and an occasional swapping of objects. As a rule, however, the extent of play was not as great as in those objects of the other pairs.

There did not seem to be any tendency for satiation from test to test under the conditions of this experiment. Any form of interruption, however, as noises in the hallways, or someone entered the room, etc., would interfere with play temporarily. The activity as a rule would start again, however, as soon as the disturbance was eliminated.

F. Summary

After a number of attempts to observe and record play behavior in puppies with failure, the present report describes a method which has been used successfully. Twelve 2½ to 3 months of age puppies were used in the test. During the sets, two puppies were together in their usual living quarters. Pairs of objects which differed in form and texture, and in one case sound quality, were placed in the kennel for a number of 300 seconds tests. Records were made on a slow moving kymograph each time an object was manipulated by either puppy. By this procedure, it was found that all objects elicited play and manipulative behavior, but three pairs were definitely more attractive than the others. Those which elicited the most play were objects which could be bitten, carried in the mouth, held with the feet and pulled, and which could be held in the mouth and shaken. In general, soft objects were more attractive than hard objects. The piece of cloth with which two animals could play together definitely elicited the most play in the present study.

References

1. Dixon, W. J., & Massey, F. J., Jr. Introduction to Statistical Analysis. New York: McGraw-Hill, 1951.
2. Welker, W. I. Some determinants of play and exploration in chimpanzees. *Jr. Comp. & Physiol. Psychol.*, 1956, **49**, 84-89.
3. ———. Variability of play and exploratory behavior in chimpanzees. *Jr. Comp. & Physiol. Psychol.*, 1956, **49**, 181-185.
4. ———. Effects of age and experience on play and exploration of young chimpanzees. *Jr. Comp. & Physiol. Psychol.*, 1956, **49**, 223-226.

Department of Psychology
University of Georgia
Athens, Georgia

The Journal of Genetic Psychology, 1961, 98, 279-293.

A DEVELOPMENTAL STUDY OF JUDGMENTS OF SEMANTIC SIMILARITY*

Department of Psychology, University of Rochester

JOHN H. FLAVELL AND DONALD J. STEDMAN[1]

A. INTRODUCTION

In a recent study by Flavell and Flavell (7) it was shown that college students' judgments of how similar in meaning a pair of words are depends in part upon the logico-grammatical relationship between the two words. For example, class—class member pairs (e.g., *bird—sparrow, fruit—apple*) tended quite consistently—independent of the *specific* words used to exemplify this relationship—to be judged more similar in meaning than action—object pairs (e.g., *sweep—floor, wash—hands*), and less similar than near-synonyms referring to adjoining points on a common continuum (e.g., *hungry—starving, cool—cold*). The present experiment is essentially a replication of the previous study using as subjects children of various ages.

Since the experimental procedure was somewhat complex and detailed, a brief orienting summary follows. Eleven categories of logico-grammatical relationships were used, each comprising a pair of words bearing the defined relationship to each other. Each pair could then be paired once with each other pair, thus making 55 pairs of pairs, called here a "set." A second set of 55 pairs could be constructed in the same way by using new word pairs to illustrate the same 11 categories. From the point of view of the logico-grammatical relationships involved, all sets constructed in this way are equivalent; from the standpoint of the particular word pairs used to express these relationships, all sets are different. In the study with college student subjects, five distinct sets were used, thereby constituting a basic "test" consisting of 275 pairs of pairs. In the present study, only three of these five sets were used in order to make a test of more manageable length for children (165 pairs of pairs). The subjects' task, as in the previous study, was to choose from each pair of pairs the one whose members seemed to them more similar in meaning. Since, within each set, each

* Received in the Editorial Office on September 4, 1959.

[1] A portion of this study is included in a thesis by the junior author: *A developmental study of meaning similarity*, University of Rochester, 1959. The study was supported by a USPHS research grant (M2632A) administered by the senior author. The authors also wish to thank Dr. Russel F. Green for his invaluable assistance in the statistical analyses.

category was paired once with each other category, such choices in effect produce a ranking of categories (1 to 11) in terms of judged similarity of meaning.

The rankings obtained in this way can be analyzed as follows, and were so analyzed in the earlier investigation: (*a*) extent of agreement among subjects' rankings within each set; (*b*) extent to which group mean rankings are similar across sets—if they are quite similar, it can reasonably be concluded that level of judged similarity is in part a function of the word-word relationship rather than of the separate words themselves; (*c*) the composition of the mean across-set rank hierarchy of relationships which the subjects produce.

It can be seen that comparisons among children and adults with respect to these measures could yield any of a number of possible outcomes. For example, it could be that, in contrast with adult findings (7), within- and across-set agreement among children is very low. If this obtains, no definite, across-set hierarchy of relationships can be identified and there is therefore no evidence that logico-grammatical relationship is a determinant of judged similarity for these subjects. Alternatively, within- and across-set agreement among children might be high enough so that it does become meaningful to identify an agreed-upon hierarchy; in which case the hierarchy in question might be similar to the adult one or it might be substantially different. And finally, of course, it is possible that the outcome varies with the age of the child, e.g., younger children might show a definite hierarchy different from that of both older children and adults. It is difficult to predict with any conviction one rather than another of these possible outcomes on the basis of the available literature on children's semantic behavior, e.g., (1, 2, 3, 4, 5, 6, 9). The one study (5) specifically concerned with the measurement of meaning in children—in this case semantic differential ratings as opposed to our direct judgments of word-word similarity—showed certain differences in semantic structure between younger and older children. This finding at least suggests the possibility of age differences in the present experiment, but implies nothing as to the specific locus of these differences with respect to the three parameters described above.

B. Method

1. *Subjects*

The subjects in the major study consisted of 10 males and 10 females at each of Grades 2-9 inclusive, thus 160 subjects in all. A different group of 9 male and 11 female second-graders were tested in a follow-up study.

All grade groups, and the male-female subgroups within each grade, were closely matched for scores on whatever group intelligence test the children had most recently taken (different tests at different grades).

2. *Test Materials*

The 11 categories of logico-grammatical relationships are defined below. The three pairs of words used in this study to exemplify each relationship follow the definitions; the first pair listed after a given definition belongs to Set 1, the second to Set 2, and the third to Set 5[2]:

a. Synonym (SY). The members of each word pair have exactly or almost exactly the same referent (*big—large, steal—rob, error—mistake*).

b. Similarity (SI). The members of each word pair are similar in meaning in the following way: the referents of both are closely aligned on some dimension, with the referent of the right-hand member occupying the more extreme position on this dimension (*small—tiny, smile—laugh, damp—wet*).

c. Supraordinate (SU). The left-hand member of each word pair denotes a common class of which the referent of the right-hand member is a familar class member, easily recognized as such (*bird—sparrow, animal—fox, tree—oak*).

d. Coordinate (COO). The members of each word pair refer to familiar, easily recognized class members of a familiar class (*cow—horse, pipe—cigar, beets—peas*).

e. Attribute (AT). The right-hand member of each word pair refers to a quality or attribute generally recognized as always or nearly always characterizing the object denoted by the left-hand member (*lemon—sour, elephant—heavy, mouse—small*).

f. Contrast (CON). The members of each word pair refer to opposite ends of a familiar continuum (*hard—easy, strong—weak, loud—soft*).

g. Action-of (OF). The right-hand member of each word pair is an intransitive verb denoting a concrete action commonly associated with and frequently performed by the agent referred to by the left-hand member (*dog—bark, lion—roar, cat—purr*).

h. Action-upon (UP). The left-hand member of each word pair is a transitive verb denoting a concrete action commonly associated with and frequently performed upon the object referred to by the right-hand member (*sweep—floor, chew—gum, throw—ball*).

---

[2] The set numbers used in the earlier publication (7) are retained here. Thus, Sets 1, 2, and 5 of the original five sets of pairs listed in that article were the ones selected for study here; Sets 3 and 4 were not used.

i. Whole-part (WP). The right-hand member of each word pair refers to a familiar object easily recognized as an important part of the familiar whole denoted by the left-hand member (*bird—wing, shoe—heel, bicycle—wheel*).

j. Part-part (PP). The members of each word pair refer to familiar objects easily recognized as important parts of a familiar whole (*pedal—handlebars, wall—floor, arm—head*).

k. Common-use (CU). The right-hand member of each word pair denotes an object commonly associated with and frequently acted upon by the agent referred to by the left-hand member (*dog—bone, farmer—tractor, soldier—rifle*).

The rationale and method of selection for these categories and word pairs is described in the earlier paper (7).

3. *Procedure*

For the subjects in the initial, major study, the test materials consisted of a standard two-choice IBM answer sheet and the test form itself—three sheets of paper stapled together with the pairs of word pairs printed so as to relate positionally to the IBM answer spaces. As in the original study (7), the first 11 pairs of word pairs on the test sheet were practice items and were not scored. The remaining 165 items were the critical ones for which choices were scored, and appeared on the test form in a random order which was the same for all subjects. Subjects in each grade were tested as a group in their regular classrooms by the junior author, with whom most of the children were already acquainted. Test administration began with an informal explanation of the IBM sheet (most subjects had had previous experience with such sheets in school testing programs). The following instructions were then slowly read aloud, supplemented with blackboard demonstrations:

> Now this test you are going to do is a funny kind of test. You see, you have the test there and also an answer sheet. Look at the test. You see groups of four words along side of each number. Next to each number there is one pair of words on the left and one pair of words on the right. For example, next to Number 1 there is on the left "cab—taxi" and on the right "propellor—wing." Do you all see them? Good. Now what you have to do for each group of words is this. Look at the two words on the left and decide whether *you* think they are closer in meaning to each other than the two words on the right are to each other—or whether, instead, the right-hand words are closer to each other in meaning than the left-hand words are. Let's

take an example. Say the words for group Number 2 are "street—apple" and "cow—milk." Now "cow" and "milk" don't mean exactly the same thing, of course, but many people might say that "cow" comes *closer* to meaning "milk" than "street" does to meaning "apple." Now it *could* be that, for some people, the word "street" tends to make them *think* of "apples"—perhaps because a man was selling apples on their street once, or something. However, in *this* test the job is to pick the words which are closer together in their *meaning—not* just in terms of whether one word makes you *think* of another word—like "street" making you think of "apple" because of a particular experience you once had. Now look at the board again. If those words were on the test and you decided that "cow" and "milk" were closer in meaning, this is what you would do. You would take your pencil and color in the little space on the *left* for Number 2 on your answer sheet (the experimenter demonstrates on blackboard and by holding up an actual answer sheet). So you see, if you pick the *left*-hand pair on any number, you color in the *left*-hand space for that number on the answer sheet.

Now in taking the test this way, there are a few rules to follow. Be sure to make a choice for *each* number—don't skip any. Be sure that you don't mix up the numbers—like making a choice for Number *24* and filling in the space for *25* by mistake. If you find you *have* made a mistake of this kind, don't worry—just raise your hand and I'll come to see you. But try *not* to make mistakes—be *very* careful. Last of all, make your choices *carefully*, keeping the instructions in your mind. But don't spend *too* long on any group—try to keep going.

Do you have any questions before we begin? All right, you can start now. Be sure and raise your hand if you run into any problems.

The children were encouraged while taking the test to raise their hands if they had difficulty in reading a word or understanding its meaning, forgot the instructions, made an error, etc., and occasionally did so, especially in the younger grades (no child reported not knowing the *meaning* of any word, however). At frequent intervals the experimenter reminded all subjects of the "closeness of meaning" set they were to adopt in their choices.

After all data were analyzed, a follow-up study was undertaken to see if the obtained results would be confirmed if a more careful and controlled testing procedure were used. Another group of 20 second-graders (referred to henceforth as Group 2A) was given the same instructions and test form but with three differences in testing procedure. The subjects were tested in groups of two (sitting back to back), the experimenter read the word pairs aloud while the subjects followed along on the test form, and the subjects circled their choices on the test form itself instead of using the IBM sheet. It was the experimenter's impression that this testing procedure produced heightened attention and task-orientation on the part of the subjects.

C. Results

Each figure includes the data from the eight groups in the major study (Grades 2-9), the additional second-grade group (2A), and the college group (C) from the earlier study (7). Findings for the major study groups and for the college group will be described first, those for Group 2A afterwards. Figure 1 shows the distribution of within-set coefficients of concordance (W) across groups (10); as used here, this coefficient expresses the extent of inter-subject rank agreement, for a given set, among the members of a given group. The figure shows that within-set agreement tends to be very low for the younger groups and gradually increases with age. It also

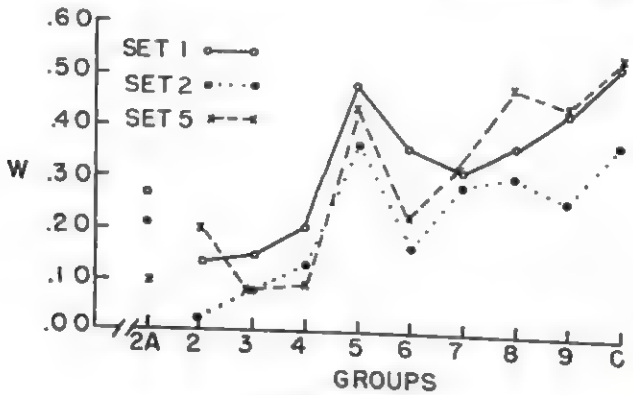


FIGURE 1
Within-Set Coefficients of Concordance (W) Expressing Inter-Subject Agreement in Category Rankings for Each Group

appears from the figure that inter-subject agreement in ranking tended generally to be less for the Set 2 pairs than for the others. Another unaccountable finding, seen also on subsequent figures, is that the fifth grade subjects behave more like the college group than the sixth and seventh grade subjects do.

Figure 2 shows comparable data on the extent to which, for each group, the group mean rankings of the separate sets agree with one another. Once again, there appears to be an upward developmental trend but, unlike the case for the within-set Ws the across-set curve seems to stabilize around Grade 5.

Figure 3 shows the across-set grand mean rank for each separate relationship category for each group. This grand mean score is for a given relationship simply the sum across sets of all subject rankings for that relationship, divided by three times (since there are three sets) the number of

subjects in the group. Figure 3 expresses much of what is contained in Figures 1 and 2 as well as providing information as to the similarity-of-meaning category hierarchies for the different groups. For example, high within- and across-set *W*s tend necessarily to produce a definite relationship hierarchy, expressed in Figure 3 as "spreading out" of the categories along the ordinate. Conversely, low within-set and especially low across-set *W*s yield a clustering of categories around the middle rank (Rank 6). Figure 3 shows clearly that a more or less definite hierarchy begins to form somewhere around the fourth or fifth grade and that this hierarchy is substanti-

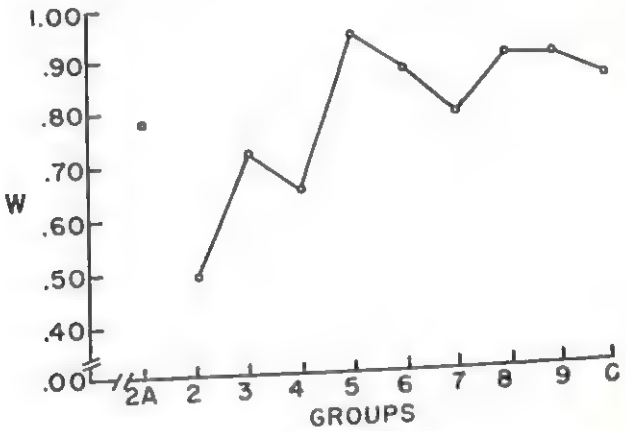


FIGURE 2
ACROSS-SET COEFFICIENTS OF CONCORDANCE (W) EXPRESSING CATEGORY RANKING AGREEMENT AMONG SETS 1, 2, AND 5 FOR EACH GROUP

ally the same as the adult one. For both Grades 2 and 3 the close grouping of scores implies a lack of hierarchization of relationships, although the Grade 3 rank-order is beginning to approach that of the older children and college students.

The extent to which the hierarchies of the various child groups approximate that of the college group is shown in Figure 4. With the exception of the Grade 2—college comparison, all rank-order correlations are high.

From the results presented thus far, the following conclusions can reasonably be drawn. The younger children do not show a definite similarity-of-meaning hierarchy among the 11 relationships, a hierarchy which the subjects tend to agree upon in both the within- and across-set sense; *a fortiori*, they show neither the adult hierarchy nor a "child" hierarchy, different from the adult one. Beginning somewhere in the Grade 3-5 period a fairly definite

ordering of relationships in terms of semantic similarity begins to emerge, and this hierarchy is essentially the adult one.

While the definite hierarchy of the middle and older groups is reasonably

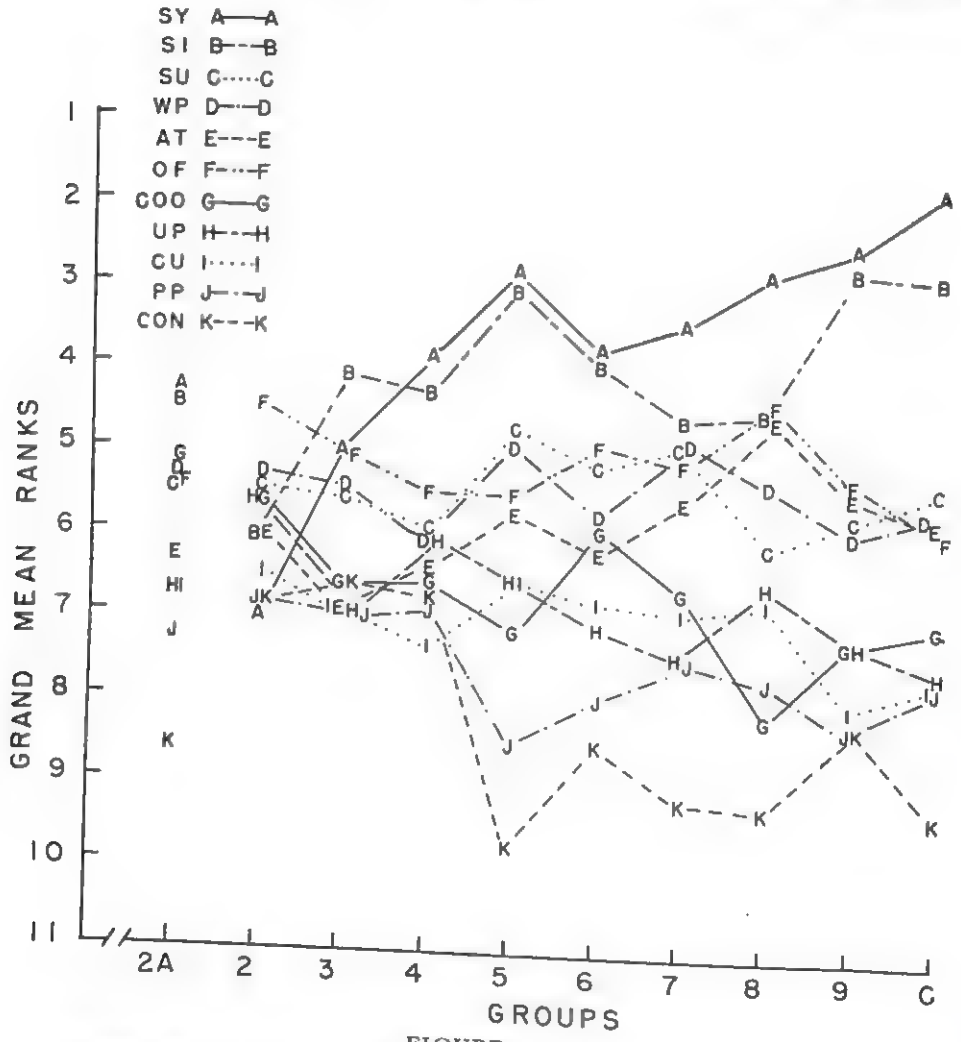


FIGURE 3
GRAND MEAN (ACROSS-SET) RANKINGS OF CATEGORIES FOR EACH GROUP

unequivocal in its interpretation, the lack of hierarchy in the younger groups is an ambiguous finding. It might be the consequence of a genuine absence of a definite and consistent strategy of judging semantic similarity among logico-grammatically related words. On the other hand, it might

be the result of error variance stemming from any of a number of sources concerning test administration, i.e., reading difficulties, fatigue or boredom in a long, repetitious task, distraction of one kind or another, and so on. It was in the hope of clarifying this ambiguity that Group 2A was examined in a quasi-individual testing situation. Examination of 2A data in Figures 1-4 strongly suggests that the testing conditions were indeed responsible for much of inchoate character of the younger groups' judging behavior. Within-set and especially, across-set *H*'s are considerably higher for these second-graders than for their group-tested counterparts in the major study

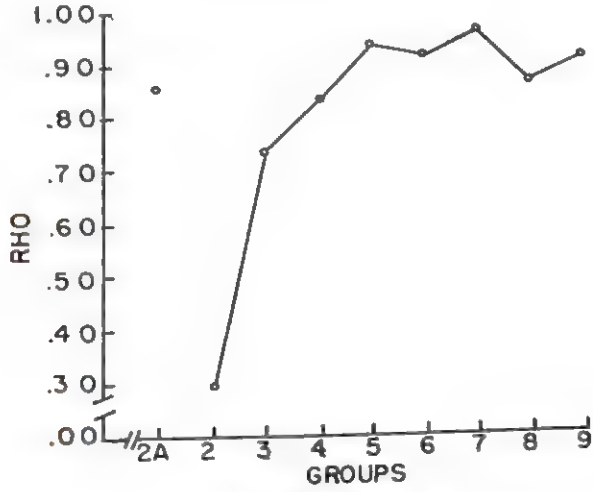


FIGURE 4
RANK-ORDER CORRELATIONS (RHO) BETWEEN THE COLLEGE (C) GROUP AND EACH CHILD GROUP WITH RESPECT TO ACROSS-SET MEAN RANKINGS OF CATEGORIES

(Figures 1 and 2). Even more striking is the definite group mean hierarchy which these subjects show (Figure 3), a hierarchy very much like that of the older groups (Figure 4).

A preliminary attempt was made to investigate possible sex differences by plotting the Figure 3 curves for the two sexes separately and comparing them. Two types of sex differences are possible here: developmental differences, or differences between sexes in the age at which the adult mean hierarchy begins to become definite; and non-developmental differences, or sex differences, independent of age, in the definitiveness of the hierarchy or in its composition. No consistent, interpretable differences of either kind could be detected by inspection, however, and no further analyses of sex differences were carried out.

D. Discussion

1. *Developmental Comparisons*

It is unusual for a developmental study to produce results which point toward an *absence* of definite developmental change with aspects to the principal dependent variable studied. Yet the present investigation seems to fall into this category. The most striking of our findings is the extent to which, under the proper testing conditions, young children of average intelligence, older children of average intelligence, and young adults of presumably above average intelligence all share a common frame of reference or strategy with respect to an unusual judgmental task, a judgment task probably quite unlike anything they had ever encountered before. Certainly to assess the relative semantic distances between pairs of words like *dog—bark* and *pipe—cigar* is beyond the pale of ordinary linguistic experience. It is difficult enough to see how a group of adults come to agree as much as they seem to do in making judgments of this kind; it seems to us nothing short of remarkable that children of widely differing ages should share to a considerable degree the same judgmental framework.

However, recent experiments by Brown (4) and Berko (1) have also shown some striking convergences between the language behavior of even very young children and adults. Like the present experiment, and unlike the conventional developmental investigation, the primary interest in the Berko and Brown studies lies in the across-age similarities they found. Brown (4), for instance, showed that pre-school children, like adults, are extremely sensitive to part-of-speech membership as a cue for meaning. For example, nonsense words with *-ing* endings were readily identified by most pre-schoolers as referring to the action components of pictures. It appears to be the case that the subtle, implicit rules of a language system, despite their great complexity, are mastered astonishingly well by even the neophyte speakers of the language (2). It may also be that similarity-of-meaning strategies are somehow induced through continuous contacts with the linguistic system and, like Brown's part-of-speech sensitivity, induced earlier than one might expect. We shall return to the problem of how such strategies might be acquired in the final section of this discussion.

The foregoing emphasis on similarities across age groups should not obscure the differences which may really be present, let alone those actually found in this experiment. As to the latter, Figure 1 clearly shows that the younger groups, Group 2A included, show more intersubject variation than the older groups. A rephrasing of this result is that more and more

subjects in a given sample approximate the modal adult hierarchy as the groups increase in age. Incidentally, at no age do the within-set *W*s exceed .60; in every group, including the adult, there definitely are subjects who appear to show highly idiosyncratic strategies, e.g., CON pairs rated as very similiar in meaning and SYN pairs rated as moderate or even low in similarity. In addition to the age differences reflected in the within-set *W*s, it is also possible that some of the small variations in mean hierarchy from group to group among the older subjects (Figures 3 and 4) are real differences and not random error. And, of course, it is always a possibility that the testing of children younger than our second-graders (if such testing can be done) might reveal hierarchy differences. Finally, there is the definite possibility that our test, sampling only a fraction of English words and only 11 of all possible word-word relationships, is simply not adequate to pick up certain kinds of genuine developmental differences in strategies. In view of age differences obtained by others in closely related areas (e.g., 5, 6, 9), it would be surprising if none exist here.

2. *The Nature of the Strategy*

Inspection of Figure 3 for those groups showing a definite, more or less common ranking of categories suggest the following partially-ordered hierarchy: (*a*) SY and SI, in that order, form one cluster at the top; (*b*) SU, WP, AT, and OF form a second cluster without consistent rank-ordering within the cluster; (*c*) COO, UP, CU, and PP tend to form a third cluster, perhaps with COO tending towards the top and PP the bottom of the group; (*d*) CON stands alone as the fourth and bottom grouping. Although it can be argued that SY (and perhaps SI) and CON form the two ends of the similarity-of-meaning continuum "by definition," the ordering of the middle clusters is hardly predictable *a priori*. In the earlier article, a not-too-successful attempt was made to discern the implicit strategy or rationale which might underlie the hierarchy (7). We have since adopted the following revised model:

a. Bilateral inclusion (SY, SI). Judged most similar in meaning are pairs such that the referent of one pair member includes or contains the referent of the other and conversely ($A \supset B$ and $B \supset A$). The more complete the mutual inclusion, i.e., the more the two referents overlap without remainder, the more similar in meaning the words are judged to be. Thus SY pairs are judged more similar than SI pairs.

b. Unilateral inclusion (SU, WP, AT, OF). Judged next most similar are pairs such that the referent of one pair member includes the referent

of the other but not the converse ($A \supset B$, but not $B \supset A$). This unilateral implication is most clearly seen for SU and WP pairs. In the case of AT and OF, the action or attribute is here construed as being contained or included in the referent object. Thus, *bark* is treated as though it were contained in *dog,* as though it were a part of *dog;* similarly, *sour* is taken to be a component property contained in *lemon.*

c. Joint inclusion (COO, UP, CU, PP). Judged next most similar are pairs whose referents are not contained in each other but are jointly contained in some supraordinate totality ($A \supset C$ and $B \supset C$, but not $A \supset B$ or $B \supset A$). Once again, COO and PP fit the paradigm more unequivocally than do UP and CU. Pair members of these latter categories are thought to have as supraordinate totalities not a common class to which they belong (COO), nor a common discrete whole of which they are parts (PP), but a common spatio-temporal context to which both belong, i.e., *sweep* and *floor,* and *soldier* and *rifle* tend to "go together" in space and time, tend to co-occur or be contiguous in many contexts without being contained in each other in the strict sense.

d. Bilateral exclusion and antagonism (CON). Judged least similar are pairs whose referents not only do not include each other and are not jointly included in a third term, but the presence of one actually precludes the presence of the other (neither $A \supset B$ nor $B \supset A$ nor $A \supset C$ nor $B \supset C$, but $A \supset \overline{B}$ and $B \supset \overline{A}$).

There are some obvious difficulties with this model as it stands. For example, Categories AT, OF, UP, and CU seem to us to fit the definition of Groups *b* and *c* above less unambiguously than do SU, WP, COO, and PP. Similarly, the model does not explain why SU and WP should, as appears to be the case from Figure 3, be more consistently similar in rank status than are their analogues COO and PP. On the whole, however, the model does appear to fit the present data fairly well and at least suggests some interesting hypotheses about similarity-of-meaning judgments. For one thing, it appears that, although a logical distinction can be made between the part—whole relationship and class member—class relationship, subjects appear to treat them as equivalent insofar as these judgments are concerned. Also, the model suggests why pairs like *dog—bark* are so consistently judged more similar than seemingly analogous pairs like *sweep—floor*—a finding which had puzzled us earlier (7). Our present interpretation, reflected in the model, is that *bark* inheres in, is "part of" *dog* in a sense in which *sweep* is not a "part of" *floor.* Finally, the model suggests one group of word pairs which does not occur in our test but which might be predicted to lie

between *c* and *d* in similarity: distantly-related pairs like *feather—statue* and *mallet—flower* which seem to have all the properties of *d* except the mutual exclusion: $A \supset \overline{B}$ and $B \supset \overline{A}$.

It would be of interest to try to refine the model further through additional experimentation. Thus, it may be that further subdivisions within the above four classes can be made by adding additional dimensions. To take only one example, in the case of Group *b* relationships, it might turn out that the more nearly A approaches B in denotative size or extension (in the Group *b* paradigm: $A \supset B$ but not $B \supset A$) the more similar A and B are judged to be, since of course the limit of this trend would be $A \supset B$ and $B \supset A$ (Group *a*). For instance, if a given class has only two subclasses or a given whole has only two identifiable parts, such class-member and part-whole pairs might be judged as more similar than in the case where there are 20 distinct subclasses and parts. In the earlier paper it was suggested that it may be worthwhile to explore possible determinants of semantic similarity other than those involved in logico-grammatical relationships (7). However, there would appear to be considerable potentiality for fruitful empirical study in the present area alone.

3. *Development of the Strategy*

The preceding section described a possible strategy by which subjects might have achieved the modal hierarchy found in this experiment. It is interesting to speculate about how the strategy might be acquired developmentally. Although the SY-CON opposition may be taught directly or indirectly in school in connection with reading and vocabulary studies, we know of no specific school experience relevant to the rank placement of the categories in between these. Moreover, it seems probable that the main outlines of the strategy are laid down in the pre-school years, presumably through experiences with the spoken rather than written language.

One possible explanation for its development might be the following. In general, it is reasonable to suppose that words come to be subjectively experienced as similar in meaning as a result of being linked together, in speech or in writing, by copulas expressing identity or similarity, e.g., connectives like "means," "is," "is like," "is part of," and others of this general type. This interpretation is a variate of the conditioning hypothesis of Mowrer (8), whereby the meaning of word A is said to become conditioned to word B if the two are linked together as subject and predicate in sentences. In the case of Group *a* words (SY and SI), copulas of the aforementioned kind connect the words in *both* directions. The child hears people say both

"an *error* is a *mistake*" and "a *mistake* is an *error*," both "a *smile* is like a *laugh*" and "a *laugh* is like a *smile*." In the case of Group *b* words (SU, WP, OF, and AT), the copula tends to connect the words in one order but not in the other. For example, the child hears "*lemons* are *sour*," but not "*sour* are *lemons*," "a *sparrow* is a *bird*" but not "a *bird* is a *sparrow*," and so on. As with Group *a* words, a strong sense of semantic similarity is induced between such pairs as a consequence of the "A is B" pairings. However, and unlike Group *a* words, the objective similarity is presumably somewhat attenuated when the child himself tries to generalize from hearing "A is B" to asserting "B is A" in the presence of socializing elders. From such corrective experiences he may come to feel that A and B are similar, but not as similar as Group *a* words. In the case of Group *c* pairs (COO, UP, CU, and PP), the all-important identity or similarity copulas are seldom if ever used as connectives. However, there is ample association by less "potent" direct connectives ("a *soldier* uses a *rifle*") and by mediated identity copulas ("*cows* and *horses* are both *animals*"). Finally, Group *d* pairs (CON), although very frequently co-occurring in the same verbal context (which probably explains their high associative strength in word association tests), tend to be linked by copulas expressing non-identity, opposition, etc. ("*strong* means the opposite of *weak*"). Similarly, unrelated words, such as the *feather—statue* example given earlier, simply appear to be words which seldom occur in the same verbal context and are therefore seldom connected by copulas of any kind.

As with the strategy model, there are numerous difficulties with this hypothetical account. One of the most important of these has to do with ambiguities surrounding the similarity-giving properties of various types of copulas. For example, are the copulas "is the same thing as" and "means" more potent in establishing subjective similarity than "is a," "is part of," "is like," etc.? Questions arise also as to whether a "strong" copula (somehow identified as such) infrequently experienced as a link between two words is as potent a conditioner of similarity as a "weaker" one which is frequently experienced as a connective. If frequency of pairing is a determinant which interacts with potency of the connective, one might hypothesize, for example, that SU pairs of high frequency of occurrence in the language (and presumbably, co-occurrence) would be judged more similar in meaning than otherwise isomorphic SU pairs of low frequency. At the moment, however, these questions have about the same speculative status as our hypotheses about the development of the judgment strategy.

E. Summary

A previous experiment had shown that college students' judgments of similarity of meaning between words depend in part upon the logico-grammatical relationship uniting the words. The present investigation constituted a replication of this experiment with children of various ages (Grades 2-9). Initially, all children were tested in large groups; subsequently, an additional sample of second-graders were more carefully examined in groups of two in an attempt to eliminate undesirable test-taking artifacts. It was found that group agreement in the rank-ordering of word pairs in terms of semantic similarity showed a more or less regular increase with age. However, the older group-tested children and the second-graders tested in groups of two were surprisingly like the college sample in the group mean hierarchy of word-word relationships resulting from the similarity judgments. Attempts were made to describe a similarity-of-meaning strategy which could produce this hierarchy and to speculate on the developmental origins of the strategy.

References

1. Berko, J. The child's learning of English morphology. *Word*, 1958, **14**, 150-177.
2. Berko, J., & Brown, R. Psycholinguistic research methods. *In* P. H. Mussen (*Ed.*), *The Handbook of Research Methods in Child Psychology*, New York: Wiley, 1960. Pp. 517-557.
3. Bousfield, W., Esterson, J., & Whitmarsh, G. A study of developmental changes in conceptual and perceptual associative clustering. *J. Genet. Psychol.*, 1958, **92**, 95-102.
4. Brown, R. W. Linguistic determinism and the part of speech. *J. Abnorm. & Soc. Psychol.*, 1957, **55**, 1-5.
5. Donahoe, J. W. Personal Communication. This unpublished study is summarized briefly in, Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. *The Measurement of Meaning*. Urbana: Univ. Illinois Press, 1957. (Footnote, p. 289.)
6. Feifel, H., & Lorge, I. Qualitative differences in the vocabulary responses of children. *J. Educ. Psychol.*, 1950, **41**, 1-18.
7. Flavell, J. H., & Flavell, E. H. One determinant of judged semantic and associative connection between words. *J. Exp. Psychol.*, 1959, **58**, 159-165.
8. Mowrer, O. H. The psychologist looks at language. *Amer. Psychol.*, 1954, **9**, 660-694.
9. Riess, B. F. Genetic changes in semantic conditioning. *J. Exp. Psychol.*, 1946, **36**, 143-152.
10. Siegel, S. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill, 1956. Pp. 312.

Department of Psychology
University of Rochester
Rochester 20, New York

The Journal of Genetic Psychology, 1961, 98, 295-298.

RELIABILITY OF THREE INFANT DEVELOPMENTAL SCALES ADMINISTERED DURING THE FIRST YEAR OF LIFE*

Department of Child Development, Iowa State University

DAMARIS PEASE, JOSEPHINE KEEFE ROSAUER, AND LEROY WOLINS[1]

Qualification of intellectual development presents a particular challenge in the study of infants.

Bayley (1) writes that there are two schools of thought regarding the value of infant tests. Some research workers feel that there are elements of infant behavior characteristic of underlying intellectual functions and that these elements can be utilized for predictive purposes. There are other researchers who believe that early intellectual growth is variable, making it difficult to predict later intelligence from infant behavior. These differing attitudes indicate the need for further research on infant tests.

A. Statement of the Problem

This study presents a comparison of the scores of 100 infants using the California Infant Scale of Motor Development, the Gesell Developmental Schedule, and the Cattell Infant Intelligence Scale. The study was designed to: (*a*) obtain the relationships existing between the three scales administered at three, six, nine, and 12 months of age; (*b*) establish the relationship of each scale with itself at different age levels; (*c*) determine whether the different scales order the infants differently; and (*d*) determine whether the same scales order the infants differently at different times.

Test data were secured concerning 100 infants involved in a larger research study conducted in the Child Development Laboratories of the Home Economics Research Department at Iowa State University (5). The present study treated the infants as a homogenous sample. The hypotheses were: (*a*) The California Infant Scale of Motor Development, the Gesell Developmental Schedule, and the Cattell Infant Intelligence Scale

* Received in the Editorial Office on September 15, 1959.

1 Journal Paper No. J-*3737* of the Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa. Project No. *1299*. This investigation was supported in part by a PHS research grant, M2963, from the National Institutes of Mental Health, Public Health Service. Acknowledgment is due the Elizabeth McCormick Memorial Fund for their partial financial support, and the staff of the Iowa Children's Home Society for their cooperation.

measure similar factors. (*b*) A given test administered at different age levels measures the same thing. (*c*) The correlations between the California Scale of Motor Development, the Gesell Developmental Schedule, and the Cattell Infant Intelligence Scale decrease as a function of age.

B. Method

To obtain test-retest reliabilities and congruent validities, Pearson product-moment correlations were computed. The Cattell IQ, the California sigma score, and the Gesell DQ were intercorrelated. All statistical arrays were normalized and given the same mean and standard deviation.

Analysis of variance was used to test the hypotheses that the infants were ordered: (*a*) the same way by different scales and (*b*) the same way by the same scales at different times. The analysis of variance also made it possible to test for individual differences. A three-way randomized block analysis (7) was adapted to the present problem.

C. Results

The correlations indicated the extent to which the three scales measure similar factors. Out of a total of 66 correlations in Table 1, 43 are significant at the 5 per cent level or beyond.

The table of intercorrelations reveals that the scales administered at three months correlate with the other scales administered at three months.

TABLE 1

Correlations Between the California Infant Scale of Motor Development, the Cattell Infant Intelligence Scale, and the Gesell Developmental Schedule Administered at Three, Six, Nine, and Twelve Months of Age

N = 100	Age level in months	Gesell 3	Gesell 6	Gesell 9	Gesell 12	Cattell 3	Cattell 6	Cattell 9	Cattell 12	California 3	California 6	California 9	California 12
Gesell	3												
	6	17*											
	9	16	27										
	12	16	32	32									
Cattell	3	51	14	11	08								
	6	27	74	34	43								
	9	24	40	60	42	31							
	12	14	32	28	74	14	41						
California	3	48	—02	08	06	—06	39	42					
	6	06	56	33	31	57	12	10	07				
	9	21	39	35	24	12	53	42	37	02			
	12	08	21	29	36	11	45	53	39	—09	43		
						12	25	43	56	00	48	53	

P.01 = .26.
P.05 = .20.
* Decimal points omitted.

The only three-months scale that correlates with other than a three-months scale is the Gesell Developmental Schedule. It correlates significantly with the Cattell Infant Intelligence Scale administered at six and nine months and with the California Scale of Motor Development administered at nine months. This table also reveals that, generally, the correlations between scales at the same age level are considerably higher than the correlations between age levels. There seems to be little, if any, tendency for the same scales at different age levels to correlate higher with each other than different scales at different age levels. Thus, the three scales, in part, tend to measure similar factors of development.

Both first order interactions with infants were significant, as can be seen in Table 2. This indicates that infants are ordered differently by the different scales and are ordered differently by the scales at different times. Thus it appears that all three scales are not measuring the same thing, and the same scale is not measuring the same thing at different times.

TABLE 2
ANALYSIS OF VARIANCE FOR FIRST ORDER INTERACTIONS

Source	df	MS	F
Infants	99	39,200.05	2.82**
Infant × Test	198	4,862.1	1.23*
Infant × Time	297	12,618.5	3.19**
Infant × Test × Time	594	3,957.5	

*$p < .05$.
**$p < .01$.

The correlations within an age level are higher than between age levels for the six-, nine-, and 12-month scales, but the correlations between age levels for these scales are significant. The correlations within an age level, from the three months intercorrelations to the 12 months intercorrelations, do not tend to decrease. Since the reliabilities of the scales do not tend to increase with time (2, 3) the different tests at the same age level do not appear to be measuring more specific abilities at older age levels than at younger ones.

D. Discussion

The correlations of the three-months scores for all three scales; the California Scale of Motor Development, the Gesell Developmental Schedule, and the Cattell Infant Intelligence Scale, tended to be progressively lower as the intervening time increased. The three-months scores showed few significant relationships to the scores at the older age levels. Each scale was measuring, to some extent, different things at the different age levels. These findings

are consistent with the results of studies by Bayley (1) and Goodenough (4). Infant tests given at a very early age apparently have no value for the prediction of later intelligence.

The Gesell Developmental Schedule and the Cattell Infant Intelligence Scale are significantly related to each other at each of the four age levels. Contrary to the hypothesis that correlations decrease as a function of age, the correlations of these two scales increased from .51 at three months to .74 at 12 months. A possible explanation for this increase is presented by Richards and Nelson (6), who suggest that an infant's behavior becomes more "mental" as age increases. Analysis of variance established that the Gesell Developmental Schedule and that Cattell Infant Intelligence Scale were measuring different factors of development at the different age levels. For example, it is possible that at any one age level both of the scales could be measuring either primarily motor performance or primarily intellectual performance. This may not be true at other age levels.

E. Summary

The present study involved a statistical evaluation of the California Scale of Motor Development, the Gesell Developmental Schedule, and the Cattell Infant Intelligence Scale. The objectives were to obtain the relationships between the three scales administered to 100 infants at three, six, nine, and 12 months of age and to obtain indices of time-infant and test-infant interactions.

The scales were, in part, measuring similar factors; they also were measuring different factors; the relations between the scales did not decrease as a function of time.

References

1. Bayley, N. Consistency and variability in the growth of intelligence from birth to eighteen years. *J. Genet. Psychol.*, 1949, **75**, 165-196.
2. ———. Mental growth during the first three years. *Genet. Psychol. Monog.*, 1933, **14**, 1-93.
3. Cattell, P. The Measurement of Intelligence of Infants and Young Children. New York: Psychological Corporation, 1940.
4. Goodenough, F. L. Mental Testing. New York: Rinehart, 1949.
5. Pease, D., & Gardner, D. B. Research on the effects of non-continuous mothering. *Child Devel.*, 1958, **29**, 141-148.
6. Richards, T. W., & Nelson, V. L. Abilities of infants during the first eighteen months. *J. Genet. Psychol.*, 1939, **55**, 299-318.
7. Walker, H. M., & Lev, J. Statistical Inference. New York: Holt, 1953.

Department of Child Development
Iowa State University
Ames, Iowa

SHORT ARTICLES AND NOTES

The Journal of Genetic Psychology, 1961, 98, 299-302.

INTELLECTIVE AND NON-INTELLECTIVE FACTORS IN A CLASSROOM TEST*

Department of Psychology, University of California, Santa Barbara

WILLIAM D. ALTUS

It would be rather difficult to argue with the proposition that two of the major sources of variance in any subject-matter test, assuming that it had a modicum of validity and objectivity, would be the verbal aptitude of the student and the motivational clusters which drive him to study effectively. Verbal aptitude in the present study was measured by the Ohio Psychological Examination, Form 21. The motivational clusters or non-intellective factors in grade-getting were inferred from a number of tests. The Minnesota Multiphasic Personality Inventory, the Wrenn Study Habits Inventory, The Allport-Vernon Study of Values, the Allport Ascendance-Submission Study, a locally constructed adjustment inventory, and the group Rorschach were all given to a summer class of 100 students enrolled in Psychology 1A. Those items from these various tests which correlated with the students' previous grade averages but which were only minimally related to the students' tested aptitude were carefully winnowed out. The items so selected were formed into a composite score, called the non-intellective scale. The r of this composite with the Ohio scores was .05. Two measures, both related to grade-getting but not to each other, were now available. The two tests were dichotomized at the median and correlated, using tetrachoric computing diagrams, with the individual items in the last classroom test given before the term was over.

An inspection of Table 1 will reveal that four subsets of items were gleaned from the 100-point classroom test, which consisted of 50 true-false, 30 matching, and 20 multiple-choice items. The first subset consists of six items which are positively and relatively equally related to both criteria employed. The coefficients in this subset imply that the student who correctly answered each question was fairly able and that he probably put some effort into studying for the test. The term, "autistic," found in Item 1

* Received in the Editorial Office on August 5, 1959.

and the expression, "erotic self-stimulation," found in Item 4 clearly seem related to richness of vocabulary and hence to verbal aptitude. The other four items in this subset would appear, on the surface, to be mainly the kind that textbook reading would yield the correct answer for. They are samples, apparently, of the kind of item that bright, well-motivated college sophomores can answer with precision.

The second subset of six items are those which only the bright students knew. It should be pointed out that three of the items are multiple choice, a type of item which usually requires more complex abilities to answer than does the relatively simple true-false type. "Chronoscope," "reminiscence," "unquantified," are perhaps somewhat unusual words, which make the more complex four-choice item more difficult from the standpoint of general vocabulary. This was not the intent of the author of the test but it appears to be the effect he obtained.

The third subset of six items are related to non-intellective items but very little to what is measured by the Ohio. This set seems to have the most unequivocal rationale of all. There are no difficult abstract terms and the content seems largely factual. If the student knew the item through reading the text he was successful; simply being verbally apt did not help him at all.

The last set of items is related neither to aptitude nor to non-intellective factors. It will be noted that five of the items are of the true-false type. Before the condemning finger is pointed, with the admonition to go and sin no more, the reader should be reminded that the first subset also contained five true-false items. The writer finds it somewhat difficult to distinguish by inspection the difference between "The neuron is the anatomical unit of the nervous system," which appears to be of no value at all, from the one in the first subset, "The cortex gives off electrical impulses," which appears to be excellent from the standpoint of both criteria. Also, why the mental age of imbeciles discriminates the hard-working student (Subset C, Item 5) but when he is asked to compare the imbecile with the idiot in intelligence (Subset D, Item 5) he gets the answer with equal facility whether he is bright or dull, hard-working or lazy is difficult to comprehend. Whatever the rationale for this subset, however, it represents a type of item which should be left out of a classroom test.

None of the 30 items in the matching group are to be found in Table 1 because it would have been necessary to show each of the three blocks of 10 questions along with the 20 matching items that went with each block. In general, they made quite good items, favoring the intelligent and the

TABLE 1

THE RELATION OF VERBAL INTELLIGENCE AND OF NON-INTELLECTIVE FACTORS TO DIFFERENT KINDS OF ITEMS IN A CLASSROOM TEST IN A BEGINNING COURSE IN PSYCHOLOGY

r_t* Ohio, Form 21	r_t* N-I Items	Classroom test items
		A. Related to both Ohio and to N-I Items
.37	.46	1. Autistic thinking is of aid in a science course.
.42	.43	2. The cortex gives off electrical impulses.
.42	.42	3. This test is an example of a non-verbal test.
.45	.53	4. Erotic self-stimulation is a form of sublimation.
.43	.30	5. The intensity of the fundamental is the overtone.
.42	.41	6. Elation is essentially a reaction involving (1) attack (2) stopping of response (3) hormonal insufficiency (4) approach.
		B. Related to Ohio but not to N-I Items
.40	.14	1. A correlation neuron is a sensory neuron.
.37	.07	2. Psychologists agree that there is a competitive instinct.
.48	.15	3. Motor learning is one kind of verbal learning.
.36	.07	4. A chronoscope is used to measure (1) blood pressure (2) time intervals (3) blood volume (4) blood flow.
.55	.30	5. Compared with our memory for poetry, nonsense syllables are (1) retained equally well (2) retained better if studied as long (3) poorly retained (4) more subject to the function of reminiscence.
.45	.20	6. The political forecasts of Dr. George Gallup could best be described as (1) unreliable (2) fairly accurate (3) unquantified (4) highly variable.
		C. Related to N-I Items but not to Ohio
.26	.67	1. Personnel efficiency reduces labor turnover.
.00	.62	2. Few college students have eidetic imagery.
.00	.56	3. Competition generally improves quality as much as it does quantity.
.10	.63	4. The negative afterimage of yellow is (1) blue (2) red (3) green (4) purple.
.03	.44	5. The upper limits of imbecility, in terms of mental age, is about (1) 7 (2) 8 (3) 9 (4) 10 years.
.18	.52	6. Men who are popular with other men tend to be (1) rather introverted (2) highly persevering (3) somewhat extroverted (4) very loyal.
		D. Related to Neither N-I Items nor to Ohio
.12	.00	1. The neuron is the anatomical unit of the nervous system.
.14	.03	2. The nerve impulse is probably both chemical and electrical in character.
.08	.10	3. Habitual attention requires much conscious effort.
—.06	.14	4. An introspective report can usually be verified.
.09	.00	5. Idiots are less intelligent than imbeciles.
—.03	.00	6. As a basis for liking women, men gave first place to (1) sexual attractiveness (2) intelligence (3) cheerfulness (4) beauty.

hard-working in about equal proportions. An example of a quite good matching item was the following: "Socially acceptable substitution of expression," for which "sublimation" was the accepted answer. The estimated tetrachoric coefficient with the Ohio was .31; with the non-intellective scale, it was .65.

In sum, it appears that one college student answers an item because he is an effective student, another student who doesn't study but who is bright is the winner on the item which follows, and yet another student, both bright and diligent, knows the third item. A fourth item is answered higgledy-piggledy by them all.

If one were to subscribe to a philosophy of test construction, he would probably want at least one-third of his test to be of such nature that only the capable *and* the studious would get the right answers. Possibly a third, but surely no more, of the test should be such that sheer diligence, divorced from aptitude, would win the prize. A few of the items, but surely much fewer than one-third of the test total should be such that the able student could reason out the item without any necessary recourse to class material, textbook or otherwise. One may well suspect that the teacher will not need deliberately to attempt writing such items: The bright and the discerning will often recognize the true answer regardless of its being textbooky, lecture-ridden, or argot-laden—his inference will be correct whether he attends class, owns a text, or takes a note. It should be noted in this connection that the Pearsonian r between the 100 estimated tetrachoric coefficients of correlation for the non-intellective scale and the analagous 100 tetrachorics for the Ohio was .27. An r of this size shows some positive relationship; certainly it is not great, nor can it automatically be counted on. Finally, as a valedictory, one should admonish the reader that the type of item for him to avoid like the plague (if this plague, unlike the Staphylococcus presently infesting the maternity wards, *can* be avoided), would be the one which the studious and the verbally apt are as likely to miss as the do-nothing and the dull. It is assumed, of course, that the reader is presently perpetrating a course or will at some future date. The writer knows no certain prescription for such avoidance: Subset 4 in Table 1 testifies too eloquently to his lapses from grace.

Reference

1. Chesire, L., Saffir, M., & Thurstone, L. L. Computing Diagrams for the Tetrachoric Correlation Coefficient. Chicago: Univ. Chicago Bookstore, 1933.

Department of Psychology
University of California
Santa Barbara, California

The Journal of Genetic Psychology, 1961, 98, 303-305.

CORRELATIVE DATA FOR FIRST-SEMESTER GRADE AVERAGES AT THE UNIVERSITY OF CALIFORNIA, SANTA BARBARA*

Department of Psychology, University of California, Santa Barbara

WILLIAM D. ALTUS

All incoming students at the Santa Barbara campus of the University were given Form $ASAI_D$ of the Scholastic Aptitude Test (SAT) in September, 1958. This test consists of two parts, a Verbal Aptitude Test (VAT) and a Mathematics Aptitude Test (MAT). The same students were also given a locally-constructed, yes-no questionnaire which, among other types of items, contained 60 which were assumed to be rather more closely related to grade-getting than to the type of aptitude test (SAT) just described. In addition to these two measures, the high-school grades for the new freshmen were also available. The University is quite restrictive in the caliber of high-school graduate it will admit; only 10 to 15 per cent of graduating high-school seniors are eligible for entrance to the University. By no means all of these finally show up at the portals of the various campuses of the University. As a consequence of these selective factors there is marked attenuation of grade averages from secondary schools. The present study was designed to answer, in part, the relative magnitude of the coefficients of correlation for secondary averages with first-semester University grades, in comparison with the two parts of the Scholastic Aptitude Test, the mathematics portion and the verbal section, and also with the 60-point set of items from the questionnaire, presumed to measure something of one's grade-getting tendency over and beyond one's aptitude.

The data for about one-half the entering freshmen class are given in Table 1. The sexes, it will be noted, are treated separately since women have a tendency to generate higher validity coefficients in earning grades through their working more nearly up to capacity than do men. The two salient aspects of Table 1 are these: First, the secondary-grade averages, even though attenuated as noted above, yield higher zero-order *rs* than any other variable there shown; second, the not unusual finding that women are more predictable is to be noted. The Verbal Aptitude Test (VAT)

* Received in the Editorial Office on August 5, 1959.

data are not shown. The *r* for VAT with first-semester grades for men was .120; for women, it was .337. In both instances, these *r*s are below the comparable .163 and .386 for the Mathematics Aptitude Test (MAT). Just why this should occur is not clear to the writer. The VAT is twice as long as the MAT and should be more reliable for that reason; further, the curricula at Santa Barbara are in the liberal arts tradition of being much more verbal than they are quantitative. One other peculiarity is the quite low validity coefficients for men, both for MAT and VAT.

TABLE 1

ZERO-ORDER AND MULTIPLE COEFFICIENTS OF CORRELATION OF CERTAIN VARIABLES IN ASSOCIATION WITH FIRST-SEMESTER GRADE AVERAGES AT UNIVERSITY OF CALIFORNIA, SANTA BARBARA

Predictive variables	*r*s and Rs of predictive variables with grade criterion					
	Men N, 130		Women N, 200		Total N, 330	
	r	R	*r*	R	*r*	R
High School Average (HSA)	.372		.439		.402	
Mathematics Aptitude Test (MAT)	.163		.386		.263	
Study Habits (SH)	.208		.221		.215	
HSA + SH		.410		.474		.436
HSA + MAT		.394		.498		.452
HSA + MAT + SH		.436		.521		.480

Table 1 tells what happens when the three tests shown there are combined for purposes of multiple correlation. For men, the combination of secondary-grade average and the 60-items from the questionnaire yielded an R of .410; secondary grades and MAT combined to give an R of .394, slightly less. For women, the MAT test was somewhat better when teamed with secondary grades than was the 60-item questionnaire, .498 to .474. When all three measures, grades in high school, MAT, and the 60 questionnaire items, are used, a multiple R of .436 is found for men, .521 for women, and .480 for men and women combined.

The greater predictability of women and the superior validity of high-school grades over other measures are findings that are traditional. It is surprising, however, that secondary grades with so attenuated a range would yield an *r* of .402 for the total population. Rather inexplicable is the finding that one's standing on a relatively short measure of mathematical aptitude is better, so far as its association with first-semester grades is concerned, than a longer, presumptively more reliable, measure of verbal

ability on which a college traditionally places a premium. More than passing strange is the finding that a 60-item questionnaire, with its simple yes or no answers, shared honors with the better of two subtests of the Scholastic Aptitude Test, Form ASAI$_D$. The items asked in this questionnaire derived from a variety of local studies by the author. Most of the questions were the kind normally found in the so-called personality test. "I avoid large parties whenever possible." "I think I would make a good leader of men," was still another question asked. "I dream frequently," and "I used to keep a diary," are still other samples from the same source. The whole set of 60 items was usually finished in eight to 10 minutes; almost no one took as long as 15 minutes. The student earned one item of credit for each one of the first 30 items that he said yes to and for each one of the second 30 that he said no to. As a consequence, the individual answer sheet could be scored in a half minute or less. In terms of taking and scoring time, this locally-constructed test was the most efficient of the lot for the purpose intended.

A major problem is pointed up by the data in Table 1. A tidal wave of college students is predicted for the next decade in California.. By 1970 about 500,000 students will be enrolled in California colleges, according to present estimates. The University may well have 100,000 of them. If the University finds its facilities overwhelmed by graduating seniors who are admissible by our present standards, there will come a question as to what criteria to use in accepting or rejecting those who knock at our doors. If the findings elsewhere in the University are analogous to those here noted at Santa Barbara, no more than 25 per cent of the variance of first-semester grades earned in the University can at present be accounted for, even with the use of coefficients of multiple correlation. This percentage is certainly less than desirable if it eventually becomes necessary to define even more narrowly who may be acceptable as freshmen in the University of California.

Department of Psychology
University of California
Santa Barbara, California

The Journal of Genetic Psychology, 1961, **98**, 307-310.

A MULTIPLE-ALLEY STRAIGHTAWAY FOR LATENCY AND SPEED MEASURES*

Department of Psychology, Emory University

WILLIAM BEVAN AND ROBERT ADAMSON

Latency and duration of running have become frequently used indices of variables presumed to be of behavioral significance. Such data have served as measures of expectancy, activity level, drive level, and incentive strength. The presently described device (see Figure 1), like the Skinner box, has the general advantage of providing for the accumulation of large amounts of data with relative ease, since it makes possible testing five animals simultaneously. In addition, one can conduct an experiment without handling the subjects, since the home cages are used interchangeably as starting and goal boxes.

The central part of the apparatus consists of five alleys mounted on a 4′ × 8′ sheet of ¾″ plywood. The alleys are constructed of 1″ dressed pine and are covered with hinged lids of framed ¼″ hardware cloth. Their height is 6-¼″, the inside width being 3″. A treadle, 6″ × 3″, is inserted flush with the alley floor 6″ from either end; it is hinged to the bottom of the floor on the outward end and held in place by a "V"-shaped tension spring at the inward end. Depression of the treadle is registered by an Acro microswitch mounted in proximity to the tension spring. Each microswitch, in turn, is in series with one channel (Channels 2-11) on an Esterline-Angus recorder. Channel 1 records the pressing of a telegraph key which serves to signal the beginning of a specific trial. Channel 12 records a pulse from a Phipps and Bird synchronous clock, thus providing for a time line for the data.

Both start and goal boxes are of identical construction. In addition, they serve as living cages during the course of an experiment. They consist of frames, 48″ × 12″ × 10.5″, made of ¾″ plywood with hinged tops and bottoms covered with ½″ hardware cloth, and are divided into five compartments, 9.5″ × 8.75″ × 10.5″, each housing an individual subject. When the cage unit is placed flush against the battery of alleys, the exit from each compartment gives access to one alley and a corresponding

* Received in the Editorial Office on August 17, 1959.

goal compartment at the far end. Exit from the startbox is controlled by a double set of doors (see Figure 2). The outer set are opaque and are parts of a single spring-loaded ½″ plywood panel which rises when a release

FIGURE 1
MULTIPLE-ALLEY STRAIGHTAWAY

key on top of the start box is pressed. This door is controlled by the experimenter, who initiates each trial by simultaneously pressing the release key and the telegraph key for Channel 1. The inner set of doors consists of clear plastic panels which freely swing into the alley and can be pushed

by the animals. The entire apparatus rests 30″ above the laboratory floor on supports constructed from angle iron and 1-inch tubular steel. At the end of any period of testing, the box containing the subjects may be removed

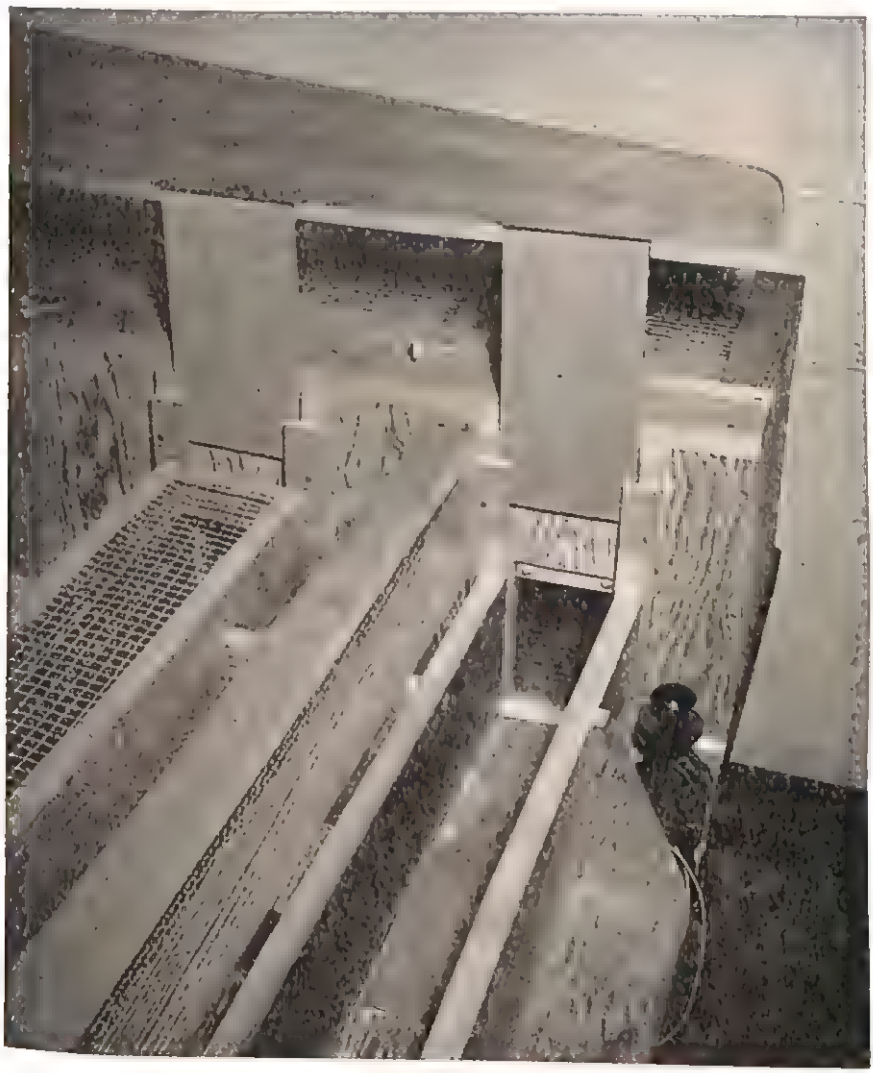


FIGURE 2
DETAIL OF ALLEY SHOWING DOOR ARRANGEMENT, START BOX, AND TREADLE: TELEGRAPH KEY SIGNALS BEGINNING OF TRIAL

from its stand and replaced with another identical box containing subjects for further testing.

The apparatus yields two scores: latency and duration of running. Latency is the time in seconds from the raising of the outer door to the

depression of the treadle nearest the start box; duration the time in seconds from depression of the first treadle to the depression of the treadle nearest the goal box.

The reliability of the latency and duration scores was obtained by a comparison of successive median scores for groups of 10 trials, a total of 160 trials being considered for a group of 25 animals. The reliability coefficient, thus obtained, for latency is 0.63; that for duration is 0.93.

Department of Psychology
Kansas State University
Manhattan, Kansas

System Development Corporation
Paramus, New Jersey

The Journal of Genetic Psychology, 1961, **98**, 311-314.

BOOKS

Now that there is a special *APA* journal completely devoted to the publication of book reviews, it is no longer necessary that other journals emphasize such publication. It has always been our conviction that book reviews are a secondary order of publication unless they carry information that is just as important as the boook. However, the publication of book titles is a very important service, and we shall continue to render that service.

In any given issue of this journal, we may continue to publish one or more book reviews, but we do not consider such publication a major function of this journal. In line with this policy, we can no longer pay for such manuscripts.

BOOKS RECENTLY PUBLISHED

ABERCROMBIE, M. L. J. The Anatomy of Judgment: An Investigation Into the Processes of Perception and Reasoning. New York: Basic Books, 1960. Pp. 156.

ARGYRIS, C. Understanding Organizational Behavior. Homewood, Ill.: Dorsey Press, 1960. Pp. 179.

BAKER, L. M. General Experimental Psychology: An Introduction to Principles. New York: Oxford Univ. Press, 1960. Pp. 420.

BARNLUND, D. C., & HAIMAN, F. S. The Dynamics of Discussion. Boston: Houghton-Mifflin, 1960. Pp. 461.

BELL, D. The End of Ideology: On the Exhaustion of Political Ideas in the Fifties. Glencoe: Free Press, 1960. Pp. 416.

BEER, S. Cybernetics and Management. New York: Wiley, 1960. Pp. 214.

BERGER, E. Tensions Can be Reduced to Nuisances: A Technique for Not-Too-Neurotic People. New York: Liveright, 1960. Pp. 239.

BERKOWITZ, P. H., & ROTHMAN, E. P. The Disturbed Child: Recognition and Psychoeducational Therapy in the Classroom. New York: New York Univ. Press, 1960. Pp. 204.

BERLYNE, D. E. Conflict, Arousal, and Curiosity. New York: McGraw-Hill, 1960. Pp. 350.

BIRREN, J. E., *Ed.* Handbook of Aging and the Individual: Psychological and Biological Aspects. Chicago: Univ. Chicago Press, 1960. Pp. 939.

BOUMAN, H. D., & WOOLF, A. L., *Eds.* The Innervation of Muscle. Baltimore: Williams & Wilkins, 1960. Pp. 223.

BOWERS, W. F. Interpersonal Relationships in the Hospital. Springfield, Ill.: Charles C Thomas, 1960. Pp. 125.

BUCKLEY, M. J. Morality and the Homosexual: A Catholic Approach to a Moral Problem. Westminster, Md.: Newman Press, 1960. Pp. 214.

BREIDIEMEIER, H. C., & TOBY, J. Social Problems in America: Costs and Casualties in an Acquisitive Society. New York: Wiley, 1960. Pp. 510.

BUGELSKI, B. R. An Introduction to the Principles of Psychology. New York: Rinehart, 1960. Pp. 571.

CALDER-MARSHALL, A. The Sage of Sex: A Life of Havelock Ellis. New York: Putnam's Sons, 1960. Pp. 292.

CAMPBELL, A., CONVERSE, P. E., MILLER, W. E., & STOKES, D. E. The American Voter. New York: Wiley, 1960. Pp. 573.

CLARK, W. E. LE G. The Antecedents of Man: An Introduction to the Evolution of the Primates. Chicago: Quadrangle Books, 1960. Pp. 374.

COTTLE, W. C., & DOWNIE, N. M. Procedures and Preparation for Counseling. Englewood Cliffs, N.J.: Prentice-Hall, 1960. Pp. 330.

CORY, D. W. The Homosexual in America: A Subjective Approach. New York: Castle Books, 1960. Pp. 334.

CRUZE, W. W. Psychology in Nursing. New York: McGraw-Hill, 1960. Pp. 536.
CUMINGS, J. N., & KREMER, M., *Eds.* Biochemical Aspects of Neurological Disorders. Springfield, Ill.: Charles C Thomas, 1960. Pp. 230.
CURTIS, J. H. Social Psychology. McGraw-Hill, 1960. Pp. 435.
DAHL, R. A., HAIRE, M., & LAZARSFELD, P. C. Social Science Research on Business: Product and Potential. New York: Columbia Univ. Press, 1960. Pp. 185.
DAVID, H. P., & BRENGELMANN, J. C., *Eds.* Perspectives in Personality Research. New York: Springer, 1960. Pp. 363.
DAVIS, H., & SILVERMAN, S. R., *Eds.* Hearing and Deafness. New York: Holt, Rinehart & Winston, 1960. Pp. 573.
DEMBER, W. N. The Psychology of Perception. New York: Henry Holt, 1960. Pp. 402.
DENBER, H. C. B., *Ed.* Research Conference on Therapeutic Community. Springfield, Ill.: Thomas, 1960. Pp. 265.
DOTY, R. S. The Character Dimension of Camping. New York: Association Press, 1960. Pp. 192.
DUNHAM, H. W., & WEINBERG, S. K. The Culture of the State Mental Hospital. Detroit: Wayne State Univ. Press, 1960. Pp. 284.
EDWARDS, A. L. Experimental Design in Psychological Research. New York: Rinehart, 1960. Pp. 398.
EELLS, R. The Meaning of Modern Business: An Introduction to the Philosophy of Large Corporate Enterprise. New York: Columbia Univ. Press, 1960. Pp. 427.
EHRENTHEIL, O. F., & MARCHAND, W. E. Clinical Medicine and the Psychotic Patient. Springfield, Ill.: Thomas, 1960. Pp. 383.
ELLIS, A. The Art and Science of Love. New York: Lyle Stuart, 1960. Pp. 400.
FARQUHAR, W. W., KRUMBOLTZ, J. D., & WRENN, C. G. Learning to Study. New York: Ronald Press, 1960. Pp. 243.
FINCH, S. M. Fundamentals of Child Psychiatry. New York: Norton, 1960. Pp. 334.
FODOR, N. The Haunted Mind: A Psychoanalyst Looks at the Supernatural. New York: Garrett, 1959. Pp. 314.
FOURASTIE, J. The Causes of Wealth. Glencoe, Ill.: Free Press, 1960. Pp. 246.
FRAIBERG, L. Psychoanalysis and American Literary Criticism. Detroit: Wayne State Univ. Press, 1960. Pp. 263.
FRENCH, E. L., & SCOTT, J. C. Child in the Shadows: A Manual for Parents of Retarded Children. Philadelphia: Lippincott, 1960. Pp. 156.
FRIED, E. The Ego in Love and Sexuality. New York: Grune & Stratton, 1960. Pp. 296.
GALDSTON, I. Medicine and the Other Disciplines. New York: International Univ. Press, 1960. Pp. 192.
GOLDFARB, N. An Introduction to Longitudinal Statistical Analysis: The Method of Repeated Observations from a Fixed Sample. Glencoe, Ill.: Free Press, 1960. Pp. 220.
GOLDSCHMIDT, W. Man's Way: A Preface to the Understanding of Human Society. Cleveland: World Publishing Co., 1959. Pp. 253.
GOTTSEGEN, M. G., & GOTTSEGEN, G. B., *Eds.* Professional School Psychology. New York: Grune & Stratton, 1960. Pp. 292.
GREENWOOD, D. The Nature of Science and Other Essays. New York: Philosophical Library, 1959. Pp. 95.
HERMANN, K. Reading Disability: A Medical Study of Word-Blindness and Related Handicaps. Springfield, Ill.: Thomas, 1960. Pp. 183.
HOCK, A. Reason and Genius: Studies in their Origins. New York: Philosophical Library, 1960. Pp. 138.
HOEL, P. G. Elementary Statistics. New York: Wiley, 1960. Pp. 261.
HOOK, S., *Ed.* Dimensions of Mind: A Symposium. New York: New York Univ. Press, 1960. Pp. 281.
JACKSON, D. D., *Ed.* The Etiology of Schizophrenia. New York: Basic Books, 1960. Pp. 456.
JENNINGS, E. E. An Anatomy of Leadership: Princes, Heroes, and Supermen. New York: Harper, 1960. Pp. 256.

JERSILD, A. T. Child Psychology. Englewood Cliffs, N.J.: Prentice-Hall, 1960. Pp. 506.

JONES, R. M. An Application of Psychoanalysis to Education. Springfield, Ill.: Thomas, 1960. Pp. 124.

KAPLAN, M. Leisure in America: A Social Inquiry. New York: Wiley, 1960. Pp. 350.

KAPLAN, B., & WAPNER, S., *Eds.* Perspectives in Psychological Theory. New York: International Univ. Press, 1960. Pp. 384.

KLOPFER, W. G. The Psychological Report: Use and Communication of Psychological Findings. New York: Grune & Stratton, 1960. Pp. 146.

KRONHAUSEN, P., & KRONHAUSEN, E. Sex Histories of American College Men. New York: Ballantine, 1960. Pp. 313.

LAIRD, D. A., & LAIRD, E. C. Techniques for Efficient Remembering. New York: McGraw-Hill, 1960. Pp. 187.

LANGER, R. E., *Ed.* Boundary Problems in Differential Equations. Madison: Univ. Wisconsin Press, 1960. Pp. 324.

LAWSON, R. Learning and Behavior. New York: Macmillan, 1960. Pp. 447.

LEE, R. H. The Chinese in the United States of America. New York: Oxford Univ. Press, 1960. Pp. 465.

LEWIS, D. Quantitative Methods in Psychology. New York: McGraw-Hill, 1960. Pp. 558.

LOGAN, F. A. Incentive: How the Conditions of Reinforcement Affect the Performance of Rats. New Haven: Yale Univ. Press, 1960. Pp. 288.

MAGARY, J. F., & EICHORN, J. R., *Eds.* The Exceptional Child: A Book of Readings. New York: Holt, Rinehart & Winston, 1960. Pp. 561.

MAY, R., *Ed.* Symposium in Religion and Literature. New York: Braziller, 1960. Pp. 253.

MARTINSON, F. M. Marriage and the American Ideal. New York: Dodd, Mead, 1960. Pp. 491.

MCCORD, W., & MCCORD, J. Origins of Alcoholism. Stanford: Stanford Univ. Press, 1960. Pp. 190.

MCGLOTHLIN, W. J. Patterns of Professional Education. New York: Putnam's Sons, 1960. Pp. 288.

MCGREGOR, D. The Human Side of Enterprise. New York: McGraw-Hill, 1960. Pp. 246.

MCGUIGAN, F. J. Experimental Psychology. Englewood Cliffs, N.J.: Prentice-Hall, 1960. Pp. 314.

MCKINNEY, F. Psychology of Personal Adjustment: Students' Introduction to Mental Hygiene. New York: Wiley, 1960. Pp. 490.

MEDAWAR, P. B. The Future of Man. New York: Basic Books, 1960. Pp. 128.

MILLER, D. R., & SWANSON, G. E. Inner Conflict and Defense. New York: Holt, 1960. Pp. 452.

MILLER, G. A., GALANTER, E., & PRIMBRAM, K. H. Plans and the Structure of Behavior. New York: Holt, 1960. Pp. 226.

MINTZ, S. W. Worker in the Cane: A Puerto Rican Life History. New Haven: Yale Univ. Press, 1960. Pp. 288.

MORSE, H. T., & DRESSEL, P. L., *Eds.* General Education for Personal Maturity. Dubuque, Iowa: Brown, 1960. Pp. 244.

MOULY, G. Psychology for Effective Teaching. New York: Holt, 1960. Pp. 550.

MOWRER, O. H. Learning Theory and Behavior. New York: Wiley, 1960. Pp. 555.

MOWRER, O. H. Learning Theory and the Symbolic Processes. New York: Wiley, 1960. Pp. 473.

MURPHY, G., & BALLOU, R. O., *Eds.* William James on Psychical Research. New York: Viking, 1960. Pp. 339.

NAGEL, E. W. Mind Power: A Guide to Extrasensory Perception Through Concentration and True Knowledge. New York: Exposition Press, 1960. Pp. 77.

NATCHEZ, G. Personality Patterns and Oral Reading. New York: New York Univ. Press, 1959. Pp. 98.

PARSONS, T. Structure and Process in Modern Societies. Glencoe, Ill.: Free Press, 1960. Pp. 344.
PARZEN, E. Modern Probability Theory and its Applications. New York: Wiley, 1960. Pp. 464.
PAUL, I. H. Studies in Remembering. New York: International Univ. Press, 1959. Pp. 152.
PEATMAN, J. G., & HARTLEY, E. L., *Eds.* Festschrift for Gardner Murphy. New York: Harper, 1960. Pp. 411.
PLUNKETT, R. J., & GORDON, J. E. Epidemiology and Mental Illness. New York: Basic Books, 1960. Pp. 126.
QUINE, W. V. O. Word and Object. New York: Wiley, 1960. Pp. 294.
RAINWATER, L. And the Poor Get Children: Sex, Contraception, and Family Planning in the Working Class. Chicago: Quadrangle Books, 1960. Pp. 202.
RAPAPORT, D. The Structure of Psychoanalytic Theory. New York: International Univ. Press, 1960. Pp. 158.
RAY, W. S. An Introduction to Experimental Design. New York: Macmillan, 1960. Pp. 254.
REAY, M. The Kuma: Freedom and Conformity in the New Guinea Highlands. New York: Cambridge Univ. Press, 1960. Pp. 222.
REIK, T. The Haunting Melody. New York: Grove Press, 1960. Pp. 376.
REIK, T. The Creation of Woman. New York: Braziller, 1960. Pp. 159.
REIK, T. The Secret Self. New York: Grove Press, 1960. Pp. 329.
RICKERS-OVSIANKINA, M. A., *Ed.* Rorschach Psychology. New York: Wiley, 1960. Pp. 483.
ROBISON, S. M. Juvenile Delinquency: Its Nature and Control. New York: Holt, 1960. Pp. 546.
ROEMER, M. I., *Ed.* Henry E. Sigerist on the Sociology of Medicine. New York: MD Publications, 1960. Pp. 397.
ROHRER, J. H., & EDMONSON, M. S., *Eds.* The Eighth Generation: Cultures and Personalities of New Orleans Negroes. New York: Harper, 1960. Pp. 346.
SARASON, S. B., DAVIDSON, K. S., LIGHTHALL, F. F., WAITE, R. R., & RUEBUSH, B. K. Anxiety in Elementary School Children. New York: Wiley, 1960. Pp. 351.
SARWER-FONER, G. J., *Ed.* The Dynamics of Psychiatric Drug Therapy. Springfield, Ill.: Thomas, 1960. Pp. 624.
SCHETTLER, C. Public Opinion in American Society. New York: Harper, 1960. Pp. 534.
SCHNEIDERS, A. A. Personality Development and Adjustment in Adolescence. Milwaukee: Bruce, 1960. Pp. 473.
SEARLES, H. F. The Nonhuman Environment. New York: International Univ. Press, 1960. Pp. 446.
SOLLEY, C. M., & MURPHY, G. Development of the Perceptual World. New York: Basic Books, 1960. Pp. 353.
SPENCE, K. W. Behavior Theory and Learning. Englewood Cliffs, N.J.: Prentice-Hall, 1960. Pp. 403.
UNDERWOOD, B. J., & SCHULZ, R. W. Meaningfulness and Verbal Learning. New York: Lippincott, 1960. Pp. 430.
WHITE, R. K., & LIPPITT, R. Autocracy and Democracy. New York: Harper, 1960. Pp. 330.